A LOOK AT LARGE SCREEN MONITORS

SILICON CHIP

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AUSTRALIA'S DYNAMIC ELECTRONICS MAGAZINE

SERVICING — VINTAGE RADIO — COMPUTERS — AMATEUR RADIO — PROJECTS TO BUILD

WHAT'S NEW IN CD ROM?

computer American Heritage Dictionary (QuickRef) 1 of 1
use of a computer. -intr. 1. To determine an amount or number. 2. To use a computer. -n. Computation: amounts beyond compute. [Lat. computare : com-, together + putare, to reckon.] computability n. computable adj.
computer n. 1. A person who computes. 2. A device that computes, esp. an electronic machine that performs high-speed mathematical or logical calculations or that assembles, stores, correlates, or otherwise processes and prints information derived from coded data in accordance with a predetermined program.
Kangaroo
(say kang-guh-ROO) Species: 60
Say what? "Kangaroo" may have been a native Australian word for "I don't understand."
Order: marsupials
Food: grasses, leaves, fruit, insects
Text World Region Index StatMap TopoMap Flip Print Quit
Soviet Union
Europe
North America
East Asia
Southwest Asia
South Asia
Middle America
Caribbean
Northern Africa
Southeast Asia
Australia & Oceania
Jaguar
(say JAG-wahr) Species: 1
Gazing from golden eyes, a jaguar—the New World's largest cat—guards its realm.
Order: carnivores
Food: rodents, peccaries, deer, fish, tapirs, cattle
Habits: solitary; nocturnal
Status: endangered by hunting and forest destruction

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SILICON CHIP

Vol.5, No.5. May 1992

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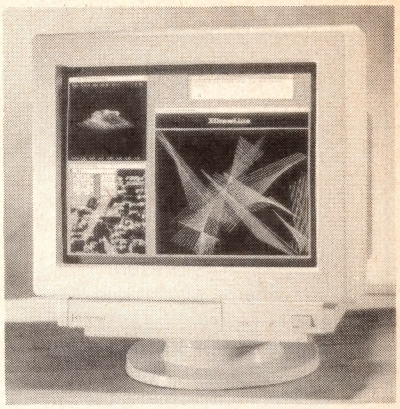
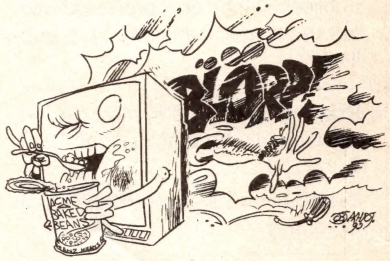
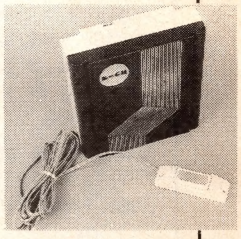


FORGET ABOUT CAD & desktop publishing on a small screen. A high-resolution, large-screen monitor is really the way to go. We tell you what to look for in our story starting on page 16.

DO YOU HAVE A COUPLE of old telephones sitting in your junkbox.? This project will turn them into a useful intercom unit that works just like a real telephone – see page 58.



THE SERVICEMAN suffered a frightening encounter with a Panasonic TV set this month. His tribulations begin on page 40.



DON'T BUY A new doorbell to replace your broken-down unit. This design comes in a special case & uses readily available parts to produce a realistic & pleasant "ding-dong" sound. Construction begins on page 30.

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ISSN 1030-2662

PUBLISHER'S LETTER

PC technology is moving rapidly ahead

This month, we are taking a look at three areas of PC technology that are evolving rapidly. The first of these is our feature article on large screen video monitors. These are not new of course and specialised labs employing CAD programs have had them for quite a few years. What is new is that they are now becoming much more affordable although most private users would still baulk at paying between $3000 and $5000 for a high resolution colour monitor and accompanying video card. Still, the prices were very much higher as little as two years ago and as computer prices have dropped so much, you can now buy a high end system with a big monitor for the same price that you would have paid a few years ago for a less capable system with a 14-inch screen.

We also take a look at one of the latest CD ROM packages. When CD ROM came out a few years ago it was stymied by a severe lack of software and the hardware wasn't cheap either. That has changed rapidly and there is now a wealth of interesting software on CD ROM. We can see many families adding a CD ROM to their home computer and thereby gaining a very good reference base for school assignments.

And finally, we take a look at OS/2 version 2. IBM's much vaunted 32-bit replacement for DOS has languished badly since it was originally released in 1987 but now it looks set to really compete with Windows-based software, with the advantage that it should operate much faster. It will be very interesting to see how much OS/2 based software appears over the next few years - the PC will evidently continue to change extremely rapidly over the coming years.

These rapid changes do present their problems though. For people considering buying a home computer so their children will not be left behind, there is a particular dilemma. Whatever computer they buy now, it is not likely to bear much similarity to the ones that will be used when their children enter the workforce in five or more years time. And for business users, the problem is that no matter what system they buy, its value will rapidly diminish in the space of two years or so. So if they are making buying decisions now, the computers must pay for themselves several times over in two years or less.

The other side of the coin is that if businesses do not continually update their equipment, and that includes their computers, then they will be rapidly left behind in the marketplace.

Leo Simpson

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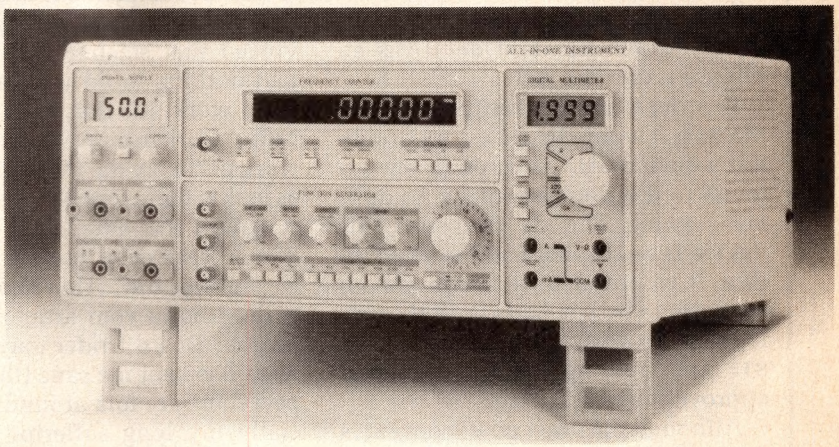

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Radiation limits for low power transmitters

An article, published in the March 1992 issue of your magazine concerning a project for a low-power UHF transmitter for use with VCRs, has come to the Department's attention. This equipment is subject to Equipment Compliance Requirement 315 (ECR 315) incorporating Ministerial Standard 315 (MS 315) for Wireless Video Equipment, copy enclosed.

If in the course of an investigation of a complaint by the Department, this device is found to be the cause, then there could be some problems for the owner of such equipment. If further investigations show that the equipment does not meet the requirements of MS 315, under the Radiocommunications Act 1983, it would become a sub-standard device. Possession of a sub-standard device is an offence under the Act.

In order to assure compliance with MS 315, it would be necessary to submit a device with an appropriate antenna to the Department for compliance testing. The fee for testing this device is $420 plus $50 for a certificate. It would also be a requirement for parts to be labelled correctly stating that the device complies with MS 315 and quoting the Departmental approval number.

Although the exact power output is not stated, the MS 315 requirement is that the peak vision carrier field strength shall not exceed 76dB microvolts per metre at three metres.

I commend your magazine for warning users of the potential to cause interference to neighbours. However, from the above it is evident that the problem could become more serious.

Jim Little,
Radiocommunications Operations Branch, Canberra, ACT.

Appreciation for the TV Serviceman

Do excuse my addressing this note to just "The TV Serviceman" but that was the writer of your "Serviceman's Log" column as listed in the index. I am not in the habit of writing fan letters but I felt moved today, just as I started to read my newly purchased copy of SILICON CHIP, to drop a few lines to express my appreciation of your column.

Indeed, I find that it is the first part of the magazine I turn to! Just can't wait to get my feet up with a cold drink at hand and read of your latest antics and trials and tribulations.

I am an electronics engineer by profession, though it would be more accurate to say hard-core tinker in all honesty. I have worked in a semiconductor factory, then serviced computers, and lately am moving into software. In all that time, and ever since I was old enough to hold a screwdriver come to think of it, I have had on many occasions cursed gremlins, damned elves and chased ghosts, convinced that science and technology had nothing to do with any of their handiwork. ICs that test fine but just do not work in circuit, computers that work perfectly the moment I so much as look at them (but not at other times), programs that adamantly believe 2 + 2 = 5, and even coils that sing an elegant soprano ... I have had my share.

Reading in your articles of similar plagues Down Under may have been what has kept me sane (though I suspect there are folk around here, especially my long suffering wife, who will claim otherwise). At the very least, it has been therapeutic to know I have not been singled out for the undivided attention of you-know-what.

On a more serious note, I have benefited from the nuggets of wisdom passed on, and have saved time, effort and money due to hints and shortcuts in your column. And the cartoons really do illustrate your points quite admirably. My compliments to the artist!

A big thank you for the entertainment, consolation and information. I look forward to reading your column for a long, long time to come.

Y. W. Loke,
Petaling Jaya, Malaysia.

Support for microprocessor kit

Regarding the suggestion that you develop a microprocessor development kit, I believe that you might be surprised at the amount of interest. It seems that there is a fair scattering of people who want to get closer to the technology than the use of a PC usually allows.

Some satisfy this urge by getting something like a Commodore 64, which is fairly powerful and yet simple enough for "hands on" experience and modification. On the other hand, if one wants to start from the ground up, there is almost nothing better than a kit for getting acquainted with the nitty-gritty. Provided the price can be kept reasonable, it would be attractive to keen students, and find use as a programmable controller for a wide range of devices.

There would be problems in choosing the chip-set for such a kit. Obviously, one type of MPU would have to be chosen and any choice would be objectionable to some potential users because of price and availability (of support chips, too) and because the order-code is not "as good" as one's preference.

Then too there are onerous decisions to take, like the notion of an RS232 (serial) interface, which would (according to some) eat up valuable board space better utilised for parallel input/output access.

It is perfectly feasible to build a small system from scratch using perf board and point-to point wiring. In fact, this is the way I built a microcontroller for a wheelchair as a TAD (Technical Aid to Disabled) project. It used a 6800 MPU, 6810 RAM (128 x 8), 2716 EPROM (2K x 8), 6821 PIA and a modicum of other components for "logic glue" and analog signal handling.

Such an effort is somewhat harder than just soldering bits into a ready-made circuit board but the sense of achievement is very rewarding.

E. Wormald,
Florey, ACT.

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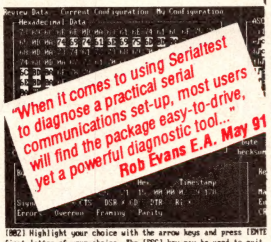
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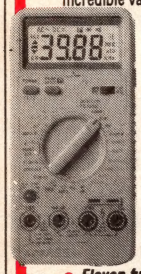

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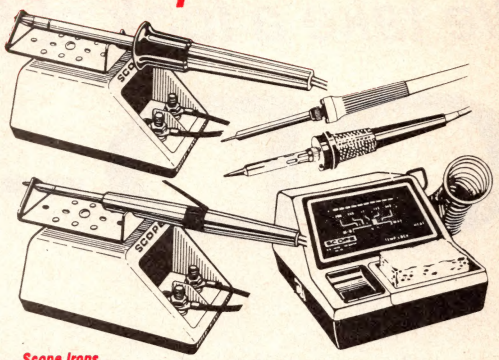

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We take a look at Sony's new

CD-ROM

If you thought that the CD ROM was just a clever toy with no real place to go, then think again. Now, more than ever, CD ROM brings a whole new world of information as close as your PC.

By DARREN YATES

Remember back to those grand old school days when you had to do those natural science assignments and you spent hours looking up books for information on all sorts of animals?

Often you found one photo and only a couple of paragraphs of information when you had to write four pages! If you think about it, it's amazing how things have changed in just the last 10 years, let alone the last 50!

The CD ROM makes it possible to store 680 megabytes of information on a single compact disc – or, in other words, a complete edition of the Encyclopaedia Brittanica from A to Z.

But if that isn't your cup of tea, then what about desktop publishing, wildlife, history, music, engineering? – the list of titles now available for CD ROM is growing all the time in a wider area of subjects.

So, when we were offered the chance to review the latest Sony package from Pelham Pty Ltd, it was a case of "who's first to play with it?" For just $1140, you can purchase everything you need to get their CD ROM up and running; from cables to the software and the CD ROM card.

But of course, the whole package is useless unless you've got software to go with it. Fortunately, they've covered this end of the wicket as well by providing a package containing six discs, each in its own container.

The titles included are Compton's Illustrated Encyclopaedia, National Geographic Society's Mammals, Languages of the World, World Atlas and CD Player Simulator software. This selection is claimed to be valued at over $3000.

The CD ROM drive itself is very compact, measuring approximately 320 x 180 x 50mm, and it contains its own power supply so that it doesn't have to reply on the computer's supply. The front panel of the drive contains a thumbwheel volume control, the CD eject button and a 3.5mm stereo socket for a pair of headphones. A dual-colour LED shows when the CD is being accessed by the computer; orange for access and green for ready.

Sony have done their best to make sure that installing the CD ROM is as easy as installing any other peripheral into your PC. They've even given you the cor-

Both the software & the hardware for Sony's CD ROM are easy to install. You can use it with just about any computer from an XT up, although at least an AT with a VGA monitor & driver card is recommended.

rect Phillips-head screwdriver to undo the computer case!

The CD ROM card is a half-width unit that will fit into any expansion socket on an XT through to a 486. There are no DIP switches to set and it's very easy to install.

The socket at the end of the card simply connects to either one of the sockets on the back of the CD ROM drive. After that, it's just a case of connecting up the power cable and you're ready to go.

Installing the software

The driver software for the CD ROM comes on a single 5¼-inch or 3½-inch floppy disc. All you have to do is load in the disc, type "llinstal" and press return.

The installation software automatically loads in and then asks you what sections of the 6-pack CD-ROM software you wish to load into your hard disc. There's a very good reason for this, too. The demo program, which is a top-grade mix of high-resolution graphics and digital stereo sound, is about eight megabytes (8Mb) long and when you add that to everything else, the total comes to about 17Mb!

Once you have decided on what software you want loaded in, the driver software prompts you to load in the correct CD and away it goes.

When it's completed, it also automatically reboots your computer so that changes it has made to the CONFIG.SYS and AUTOEXEC.BAT files take effect.

If you had enough room on your hard disc to load in the demo program, go to the LASERLIB directory and type "lldemo" and press return and you'll learn briefly how the CD ROM system works.

The unit is supplied complete with six CDs, including Compton's Illustrated Encyclopaedia, National Geographic Society's Mammals, Languages of the World, World Atlas and CD Player Simulator software.

Six-pack software

As mentioned before, there are six CDs provided with numerous reference titles. To give you a taste of what you can expect, we'll take a brief look at a couple. To load in one of the CDs, you have to load it into a plastic caddy which then fits into the CD ROM drive. When you consider that some CD ROM drives now do without this caddy system and no CD players have it, you wonder why Sony has persisted with it. From our point of view, it was about the only negative feature of the whole package.

But that aside, you only need to change discs when you change applications.

CD music sampler

Although not one of the bigger programs, this is one that is sure to be a hit in just about every workplace (including here in our editorial offices)!

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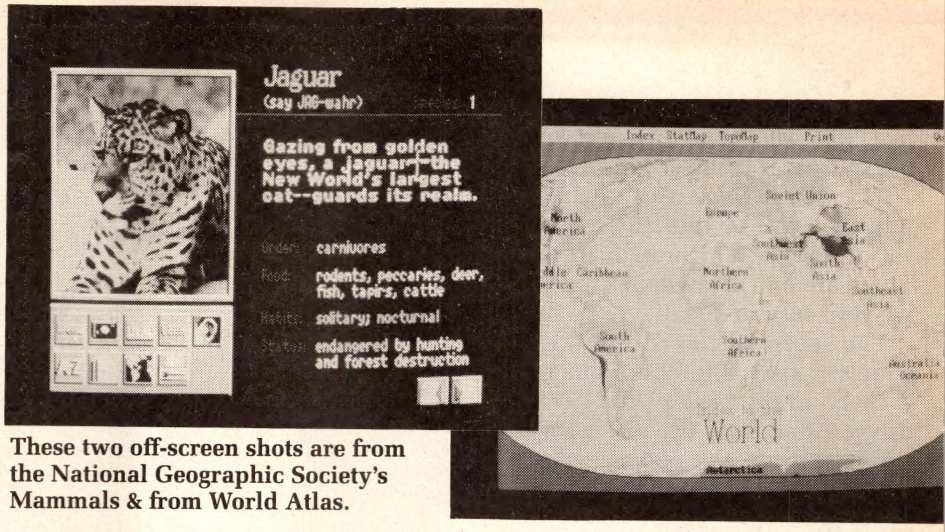

These two off-screen shots are from the National Geographic Society's Mammals & from World Atlas.

This program allows you to play your favourite music CDs through your CD ROM and even has a VGA screen display of one of Sony's CD players, complete with shuffle play, repeat and all the standard CD player features.

But the best thing from a work point of view is that the software is clever enough to be able to play your CDs in the background while you get on with other work on the computer. That's pretty clever stuff. And what's more, the sound quality is just as good as from any conventional CD player.

Sony even provide you with a pair of stereo headphones that plug straight into the front of the CD ROM for private listening while you work.

National Geographic

The most spectacular package comes from the National Geographic Society. Called "Mammals" the program contains information on over 200 mammals, all complete with full colour photographs.

But this is where the CD ROM leaves books behind. Also included are sound recordings and real life footage from some of the National Geographic films on a large number of mammals. You can even get a printout of the information provided on a particular screen by clicking on the PRINT tile.

To be able to store so many audio recordings of the mammals shown, the right and left channels contain different tracks. For example, when you listen to what an old-world monkey sounds like, the sound is reproduced in the left ear. If you listen to, say, a moose later, you may hear that in the right ear.

If you play the Mammals CD via the CD player software, you'll hear a myriad of animal sounds in both ears.

CD ROM catalog

Also included in the "6-pack" is a CD ROM catalog which shows the CDs currently available from Sony. The list is truly diverse and includes, among other things, an aircraft registration compendium, Battle Chess, CIA World Fact Book, Variety's Video Directory, Shakespeare on Disc and Coate's Art Review. They're priced at between $80 and $500, depending on the application.

One CD contains the complete 26-volume edition of Compton's Family Encyclopaedia with over 32,000 articles, 1500 illustrations and sound recordings. What's more, you don't have

The CD is placed in a plastic caddy before being inserted into the player.

to flip through reams of pages; instead, you just follow the pathways to the particular subject of interest.

Again, the same method of storing so many sound tracks has been used here. If you play this disc through the CD player software, you'll hear two separate tracks in both right and left ears. The program, of course, only allows you to hear the sound recording of interest.

World Atlas

One way to help with geography assignments is to have a good atlas and this CD ROM system has one. It gives you a picture of the world and by using either the keyboard or a mouse, you can select any region of interest and it will display that almost instantly on screen. You can then select any country from that particular region and look at it more closely.

Overall, the CD ROM system allows you to instantly access a whole world of information previously only available at large reference libraries. As a teaching tool, it provides students and teachers alike with fast, instant information on the latest topics from music, science, art, biology, history and geography – the list goes on.

With the way that CD ROM is expanding, it won't be long before you can buy the software as easily as you can buy music CDs.

The Sony CD ROM package from Pelham is a real winner. At only $1140, it represents terrific value for money, particularly when you consider the amount of information being made available and the current cost of many of the reference works provided.

Although many of the CDs available use high-resolution VGA graphics, many CDs also support CGA and EGA standards as well and there are plenty that don't even require graphics cards. So there are lots of good reasons to consider a CD ROM for your computer.

If that doesn't interest you, think of the complexity of the games that will be possible – at the very least, you should get digital stereo sound and motion picture graphics.

The system reviewed here comes complete with drive, CD ROM card, installation software, the "six pack" reference library, CD cassette tray, cables, headphones, screwdriver and user manuals. The system requirements are an XT or AT personal computer, 512Kb RAM minimum,' DOS 3.1 or higher, a hard disc, and a VGA card and monitor (recommended).

For more information, contact Pelham Pty Ltd on (02) 980 6988; or see them at 1st Floor, 100 Yarrara Rd, Pennant Hills, NSW 2120. **SC**

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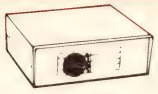
RS232 X OVER $59
RS232 2 WAY AUTO.....$69
CENTRONICS 2 WAY....$39
CENTRONICS X-OVER.$59
CENTRONICS
2 WAY AUTO.$69
CENTRONICS 4 WAY.$69

NEW SWITCH BOXES



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DB9 + 5 PIN DIN....$69.95
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4 WAY.....$59.95

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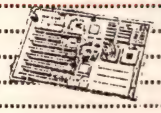

286-12/16.....$109
286-16/21.....$159
386SX-16.....$295
386SX-20/27.....$325
386SX-25/31.....$350
385-25.....$525
386-33 64K CACHE.....$645
386-33 WITH 128K CACHE.....$749
486SX-20 .....$895
486-33 256K CACHE.....$1295

SUPA VGA COLOUR MONITOR 3 YEAR WARRANTY

This stylish & reliable monitor has been designed for Australian conditions and comes with a 3 year warranty.
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Display Size: 245+/5mm x 180+/-5mm x 180+/-5mm
Resolution: (max): 1024 x 768
Dot Pitch: 0.28" $469.00

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The ultimate sound card that plugs into ant internal slot in your IBM or compatible
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Comes complete with:
- VP442 Card
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- 2 Diskettes (driver & utillity)
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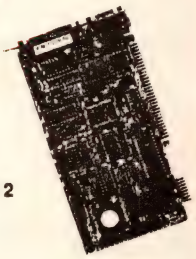
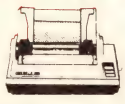
- 16 to 15 interface cable for GAMES PORT.

X18066.....$139.00



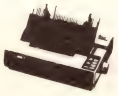
SAVE ON OUR GREAT RANGE OF EPSON PRINTERS

LX-400 80 Col, 9 Pin Dot Matrix, 180 Cps Draft 30 Cps NLQ, Pull Tractor
C22054.....$249



LX-850 80 Col, 9 Pin Dot Matrix, 240 Cps Draft 48 Cps NLQ, Push Tractor, Smart Park Feature
C22074.....$365

FX-850 80 Col, 9 Pin Dot Matrix, 264 Cps Draft 54 Cps NLQ Push Tractor Smart Park Feature
.....$750

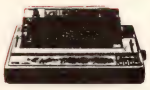


FX-1050 136 Col, 9 Pin Dot Matrix. 264 Cps Draft, 54 Cps NLQ, Push Tractor, Smart Park Feature.
.....$925

SQ-850 80 Col, 24 Nozzel ink jet, 600 Cps Draft, 198 Cps LQ, Push Tractor, Smart Park Feature.
.....$1,225

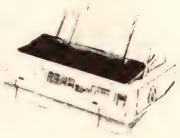
LQ-200 80 Col, 24 Pin Dot Matrix 192 Cps Draft, 64 LQ, Pull Tractor, 8 Bit Map fonts.
.....$475

SQ-2550 80 Col, 24 Nozzel ink jet, 600 Cps Draft, 198 Cps LQ , Push Tractor, Smart Park Feature,
.....$1995



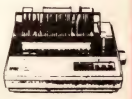
LQ-400 80 Col, 24 Pin Dot Matrix, 180 Cps Draft, 60 NLQ Pull Tractor
C22070.....$439

LQ-570 80 Col, 24 Pin Dot Matrix, 252 Cps Draft, 84 Cps, NLQ Scalable Fonts 8 to 32 points, 11 LQ Fonts 360 x 360 DPI, Top, Rear, Bottom and Front paper feed paths, Convertable Push/Pull Tractor.
.....$575

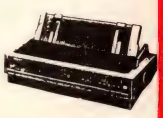


LQ-870 80 Col, 24 Pin Dot Matrix,330 Cps Draft, 110 Cps NLQ, Scalable Fonts, 8 to 32 points, 11LQ Fonts , 360 x 360 DPI, Top, Rear, Bottom, & Front paper Feed paths Convertable Push/Pull Tractor.
.....$895

LQ-860 80 Col, 24Pin Dot Matrix' 295 Cps Draft,98 CPS LQ, Colour Standard,Push Tractor Smart Park Feature.....$1095



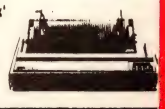
LQ-1070 136 Col, 24 Pin Dot Matrix, 252 Cps Draft, 84 Cps NLQ, Scalable Fonts, 8 to 32 point, 11 LQ Fonts, 360 x 360 DPI, Top, Rear, Bottom, and Front Paper Feedpaths, Convertable Push/Pull Tractor
.....$775



LQ-1170 136 Col, 24 Pin Dot Matrix, 350 Cps Draft., 110 Cps NLQ, Scalable Fonts, 8 to 32 point, 11 LQ Fonts, 360 x 360 DPI, Top, Rear, Bottom, and Front Paper Feedpaths, Convertable Push/Pull Tractor
.....$1,149

LQ-1060 136 Col, 24Pin Dot Matrix' 292 Cps Draft, 98 Cps LQ, Colour Standard,Push Tractor, Smart Park Feature.
.....$1,395

LQ-2550 136 Col, 24Pin Dot Matrix' 400 Cps Draft,133 LQ Colour Standard,Push Tractor, Smart Park Feature.
.....$2,049



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A tramsformer powered soldering station, complete with a low voltage, temperature controlled soldering pencil. The special Wellar "closed loop" method of controlling maximum tip temperature is employed, thereby protecting temperature sensitive components while the grounded tip protects voltage and current sensitive components. The soldering pencil features a stainless steel heater construction, a non-burning silicon rubber cord and a large selection of iron plated tips in sizes from 0.8mm diameter to 6.0mm diameter with a choice of tip temperature of 315° C/600°F, 370° C/700° F and 430° C/800°F.

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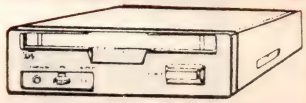

Open up a whole new world of sight and sound user interaction with a CD-ROM Drive Unit.You have never seen such a wealth of infomation and entertainment with audio and visual response that will truly astound you. You can even play and listen to your audio CD'S while continuning to use your computer

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SPECIFICATION

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Disc diameter.....12cm
Disc speed.....200-530rpm (CLV)
Data capacity.....540 MBytes
Data transfer Rate
Sequential..150KBytes/sec. (Mode 1) 171KBytes/sec. (Mode 2)

NOW ONLY $599.00

Double your disk storage with....

DR DOS 6.0

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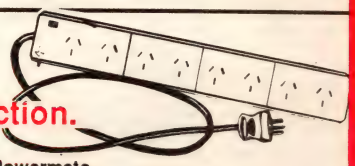
The most advanced, fully DOS-compatible operating system available today. It's everything you need to run your DOS, Windows, and networking applications faster.
Maximize hard disk performance, keep your system and Data secure, and make your PC easier to use.
DISKMAX: Improves your PC's overall performance so you can get more work done in less time. Its optional automatic file compression feature potentially doubles your hard disk storage space.
MEMORYMAX: moves DR DOS buffers, drivers, TSRs and networking software outside the 640K memory area, leaving more memory for your DOS, Network and Windows applications.

THIS MONTHS PRICE IS THE LOWEST YET!..... $99.00

THE POWERMATE "GREAT 8" with Overload Protection.



Ideal for the garage or home. The Powermate "Great 8" has 8 outlets for all types of appliances plus it provides extra safety. It has Overload protection. If it is overloaded (operating appliances that totally exceed 2400 watts or 10 amps). The overload swtch will trip, automatically turning off all appliances plugged into the Powermate. If it does overload you simply push the reset button and power is restored.

P18044 .....$39.95

CITIZEN™ PN48™ Notebook Printer

SAVE $100 THIS MONTH

Welcome to the new world of notebook printers. The PN48 Notebook Printer is the first printer that is every bit as portable as the new notebook computers. Weighting approximately two pounds without the battery (2 1/2 pounds with the battery), you can add the PN48 to your portable office and hardly know it's there.

PN48 FEATURES:

Despite the remarkable small size (11 5/8" x 3 1/2"), the PN48 is the worlds first truly portable laser quality printer, offering the same versatility and superior printing quality made famous by other Citizen printer. The Notebook Printer is compatible with Citizen GSX- series 24-wire printers. Has two built-in fonts, Roman and Courier; five pitch selection; and the ability to print on overhead projector transperancies. You will find the PN48 easy and fun to use. It's simple to operate, connecting your computer is a snap, and both print cartridges are designed for long and dependable trouble free wear.

• Graphic resolution as high as 360 x 360 dpi:

C22199..... $699

EXPANDED DYNAMIC RAM RANGE

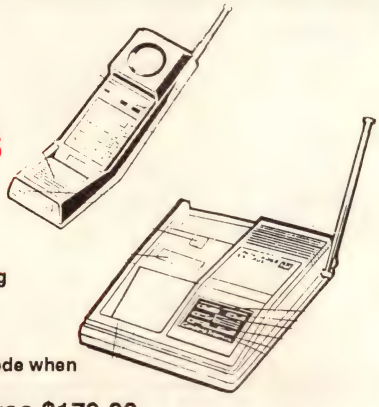
	Speed (ns)	No. of pins	1-9	10+	100+	1000+
4164-10	100	(64K x 1)	$4.95	$4.50	$2.90	$2.25
4464-08	80	(4 x 64K)	$6.95	$5.95	$3.50	$2.95
41256-08	80	(256K x 1)	$3.95	$3.50	$2.50	$1.95
44256-07	70	(256K x 4)	$9.95	$8.95	$8.50	$6.95
1M-10	100	(1M x 1)	$10.95	$9.95	$7.95	$7.50
1M-08	80	(1M x 1)	$12.95	$10.95	$8.95	$7.50

	Speed (ns)	SIMMS 1-9	10+	100+	500+
256K x 9	80	$21.00	$19.00	$18.00	$16.00
1M x 9	80	$79.00	$75.00	$69.00	$59.00
1M x 9	70	$79.00	$75.00	$69.00	$59.00

		1-9	10+	25+
4M x 9	80	$295.00	$275.00	$250.00

	Speed (ns)	SIPPS 1-9	10+	100+	500+
256 x 9	80	$21.00	$19.00	$18.00	$16.00
1M x 9	80	$79.00	$75.00	$69.00	$59.00
1M x 9	70	$79.00	$75.00	$69.00	$59.00

CORDLESS TELEPHONE MODEL 660 AUS



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This is our biggest selling external modem that features - V22 bis, V22 , V23 (with auto BRC), V21- (2400bps, 1200bps, 1200/75bps, 300bps) Auto Baud Select, Hayes "AT"commands set, Auto Answer, auto Dial, Auto Disconnect. This modem will suit almost any computer with a RS232 serial port. Telecom approved.
2400bps for only $389.00

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ALL FOR ONLY
$2895 Inc. Tax

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This new generation memory enhanced board offers 0 wait state high speed operation. It takes up to 6MBytes of 4 x 256K or 1 x 1M DRAM chip. Up to seven cards can be used together (42MB EMS). It is 100% EMS 3.2 & 4.0 compatible, and best of all it can be used in an XT, AT or 386 because it is 8 bit, 16configerable. So get yourself a Mega for the price of a mini.

X18051.....*SAVE $50.00*.....$249.00

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The PE-514 has 4 port serial ports for asvnchronous communication. These ports can bve used to connect your PC with a serial printer, MODEM, Serial mouse or serial devices which use an RS232C interface. The interface is a DTE type with a male DB25P for 4 serial port output. It supports DOS & XENIX.
X18155.....$199.00

GeniScan GS-4500

The GS-4500 is a hand held scanner that can transfer graphic images such as photographs, drawings, text and clip art directly to your computer screen. It is capable of scanning up to 105mm in two different modes, Letter or Photo. The GS-4500 also has a resolution control switch to select the amount of brightness to be used.
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The ULTRA 15C provides intelligent caching up to 16 MBytes of cache memory to make the drive "invisible" when a cache hit is achieved providing multiple increases in I/O performance. It is AT register & BIOS compatible. It supports two high transfer IDE drives. It supports the largest selection of hard drives in the market today. The ULTRA 15C also supports any mix (5.25" and 3.5") of up to three floppy disk drives or floppytapes. In addition to the special support to break the support to break the 1024 cylinder and the 528MB partition limits of DOS and OS/2, the ULTRA family of caching controllers will also co-reside with any other controller to support dual channels and/or duplexing/mirroring in popular network operating systems. $649.00

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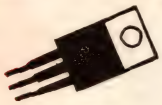

TIP 120
T90517.....$2.90

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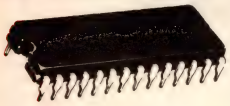
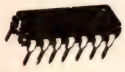
U10175.....$15.00



INS 16550 AFN UART
U22187.....$23.95



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U10416.....$2.95
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2 UNIVERSIAL BRACKETS WITH SCREWS TO MOUNT 3 1/2" HARD DRIVES INTO MOST COMPUTER CASES
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FOR BUBBLE JET PRINTERS
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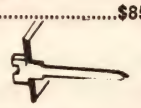

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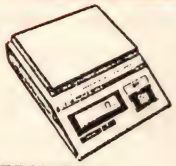

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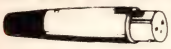

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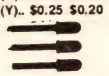

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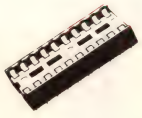

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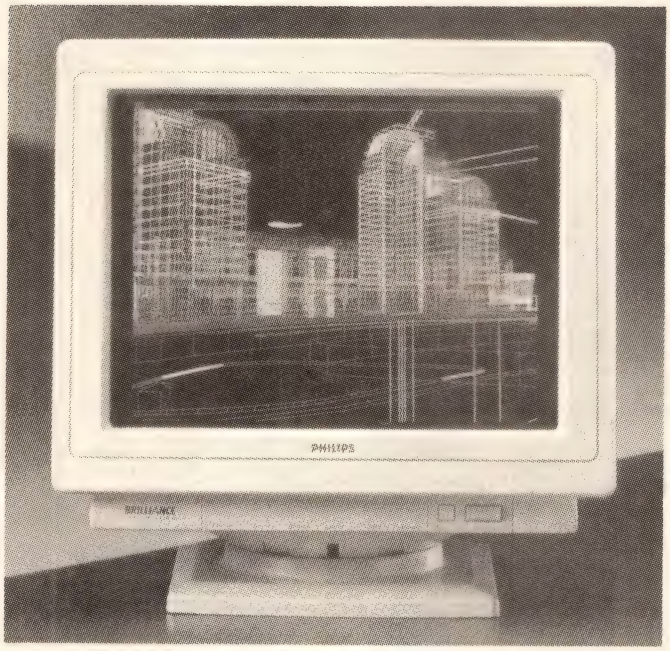
Computing On The Big Screen

Forget about CAD & desktop publishing on a small screen. To really work with these programs, you need a large-screen, high-resolution monitor.

By JIM SHARPLES*



The Philips 4CM2799 20-inch colour monitor supports resolutions up to 1280 x 1024 & can be used with a wide range of video driver cards.

The recent popularity of GUIs (Graphical User Interfaces) and WYSIWYG (What You See Is What You Get) has resulted in a marked decrease in the prices of monitors, particularly the colour models.

The advent of Windows 3.0 in the IBM PC compatible market has created a huge demand for colour monitors capable of displaying higher resolutions than ordinary VGA. These higher resolutions are referred to as "Super VGA" and can not only display the 640 x 480 pixel resolution of standard VGA, but also 800 x 600 and 1024 x 768 resolutions. Many of the larger monitors also support 1280 x 1024 but there are not (yet) many video cards able to display at this resolution.

Most of the recent monitors are the "multisync" type; ie, they synchronise at multiple frequencies. This means that IBM compatible users aren't the only ones to score – Mac, Amiga and other computers can use the same monitors.

Larger monitors

With the increase in resolution, there is a corresponding demand for larger monitors. It's very nice having a 14-inch monitor displaying Windows or CAD (Computer Aided Design) in 1024 x 768 resolution but everything is so small! Just try using a 14-inch monitor, swap to a large monitor for a week or so, then return to the 14-inch monitor. You'll really miss that large screen.

For some applications, the smaller size is not much of a problem but for others, such as desktop publishing, CAD and graphics, larger screens are almost a necessity. If you try doing a 2-page layout in PageMaker or Ventura, for example, the resulting display is practically unusable. Or what about trying to design a large double-sided board on a small screen. It is possible but not the most efficient way.

Colour or mono?

Eighteen months ago the price gap between colour and monochrome monitors was fairly substantial and if the application didn't absolutely require colour, then monochrome was certainly the most economical purchase. Now, however, the price gap has narrowed to the point where monochrome would not be a wise choice, particularly as many newer programs rely on colour to make them easier to use. Menus, grids, tools, icons, selection areas and many aspects of the programs use colour to make the user's job more instinctive and obvious.

Windows 3.0 is a good example. Whereas Windows 2.0 hardly needed colour and indeed, it was just a luxury,

Windows 3.0 was designed to use colour. In fact, it is somewhat difficult to use quite a few applications in monochrome!

CAD is another software category where colour is almost essential, particularly with multi-layered applications such as circuit board design. Drawings quickly become confusing and hard on one's concentration.

But what about the difference in quality between monochrome and colour? Let's face it – monochrome will beat colour hands down in a contest where resolution is the same. It's much easier having one electron gun than trying to align three at once.

Again, things are changing. The resolution of colour monitors is improving all the time, to the point where it doesn't really make that much of a practical difference, and in any case the advantages of colour outweigh the clarity of monochrome.

How large?

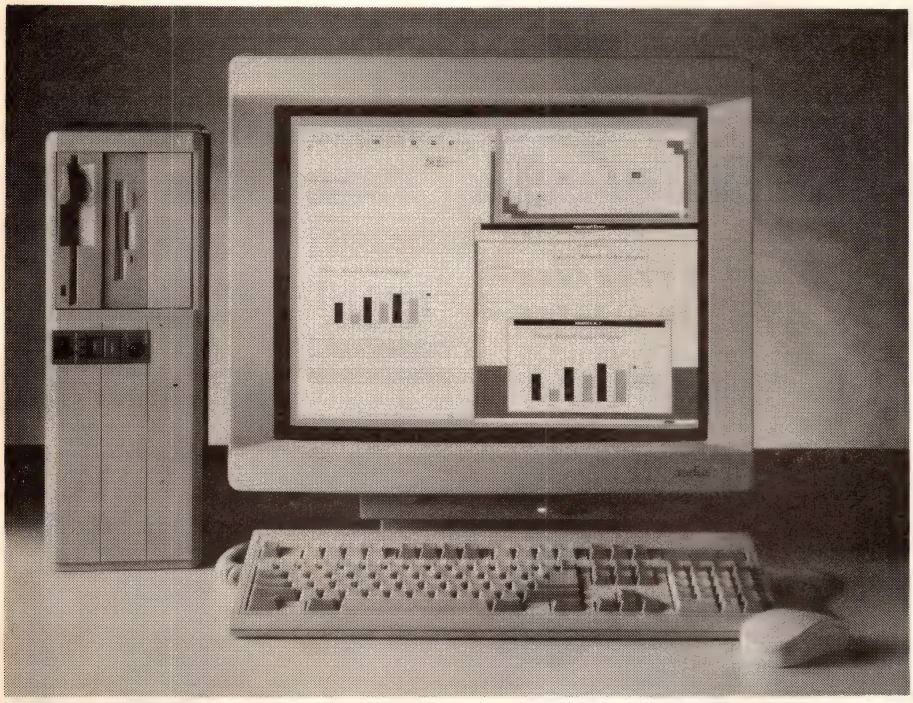
OK. We've decided on a large colour monitor. What is the best size to go for? Well, here's where personal taste steps in. In my view, a 17-inch monitor is ideal for the broadest range of applications, whether they be text-based (eg, wordprocessing or database under MS-DOS) or graphics-based as in Microsoft Windows. Text-based applications can be rather overpowering when viewed on a 21-inch monitor, unless you happen to be very short-sighted, in which case they are a great idea. I know of one person who bought a 20-inch monitor for this very purpose.

(By the way, notice how we still persist in measuring monitor diagonal sizes in inches? Obviously, this is the strong influence from the American computer industry).

17-inch monitors

As mentioned, this is the best general purpose monitor size. They have the added advantage of taking up a little less space on the desktop, though even a 17-inch monitor seems huge after a standard 14-inch one. There haven't been many of this size monitor around until a recent flurry of announcements by various manufacturers. It seems they all suddenly realised that this would be the logical choice for many users and announcements have been appearing hard on the heels of one another.

Another curiosity is that they have appeared with almost the same specifications: flat screen, 1280 x 1024 maximum resolution, 0.26mm dot pitch and very similar horizontal and vertical scan rates and bandwidth. These specs are pretty good for this



This 19-inch high-resolution monochrome monitor from Radius is ideal for desktop publishing & graphics design. It is fully VGA compatible & can be used with either PC or Macintosh systems.

A video glossary

Autosizing: this is the ability of the monitor to maintain a constant image size across different video modes. For example, this is important when entering Windows in 1024 x 768 non-interlaced mode from the normal DOS VGA mode. If this is not available, either automatically or as a user-programmable option, then the user must change the size and position of the image every time another mode is entered.

Dot Pitch: the distance between the holes in the shadow mask in a colour monitor. The shadow mask (which sits behind the screen) ensures that each electron beam (from the red, green and blue guns in the tube's neck) hits the correct dot in each triad of red, green and blue phosphors. The smaller the dot pitch, the finer the grain of the image.

Horizontal Frequency: how often the monitor scans a horizontal line, measured in kHz. VGA is standardised at 31.5kHz, while Super VGA varies depending on the vertical refresh rate of the graphics adaptor.

Multisync: a term originated by NEC to indicate that the monitor can synchronise to any horizontal line frequency within a given range. Some cheaper monitors are actually "multiple fixed frequency" which means that they synchronise to particular modes, usually VGA 800 x 600 and 1024 x 768.

Pixel: the smallest triad or group of triads, depending on the resolution selected.

Triad: a triad comprises three phosphor dots – red, green and blue – arranged in a triangle. Each of the three electron guns is assigned a particular colour and that gun excites only its own phosphor dot in the triad. The combination of excited dots determines pixel colour.

Vertical Frequency or Refresh Rate: how often the monitor scans a compete screen, measured in Hz (cycles per second). The higher the refresh rate, the less flicker is noticeable. Standard VGA has a vertical frequency of 60 or 70Hz, while Super VGA should be an absolute minimum of 56Hz but preferably 70Hz or higher.

Video Bandwidth: the highest video input frequency the monitor can accept, measured in MHz. This determines the maximum resolution.

size of monitor and should make them a popular choice.

19 & 21-inch monitors

These are the big ones, needing plenty of desk space. Don't try to use them on a narrow desk – you'll land up with the keyboard in your lap! And do a weightlifting course before moving the monsters. They are definitely in the heavyweight class.

Once in place however, the view is worth it. Both graphics and text are easier to see and manipulate, reducing the need to zoom in on working details. There is a corresponding saving in screen redraw time between the zoom levels. Monitors in this class usually have a 0.31mm dot pitch, which is quite acceptable, though some go as low as 0.28mm.

This is the ideal monitor size for those working almost exclusively in high-resolution graphics mode, whether it be CAD, desktop publishing, animation or even large spreadsheets. Maybe accountants could also benefit from a larger view of all those figures.

Portrait & 'full page' monitors

What is a 'full page' monitor? A number of times I have been asked to recommend a monitor to fit this vague notion and when pressed to clarify the request, the customer usually answers: "a monitor that displays an A4 page". My answer is almost always in the form of another question: "What size would you like your A4 page to be?".

The person wanting a full page monitor usually needs it for a desktop publishing application and I have to point out that even a 12-inch monitor can display a full A4 page. But if they want it displayed full size, the options are limited and are pretty expensive.

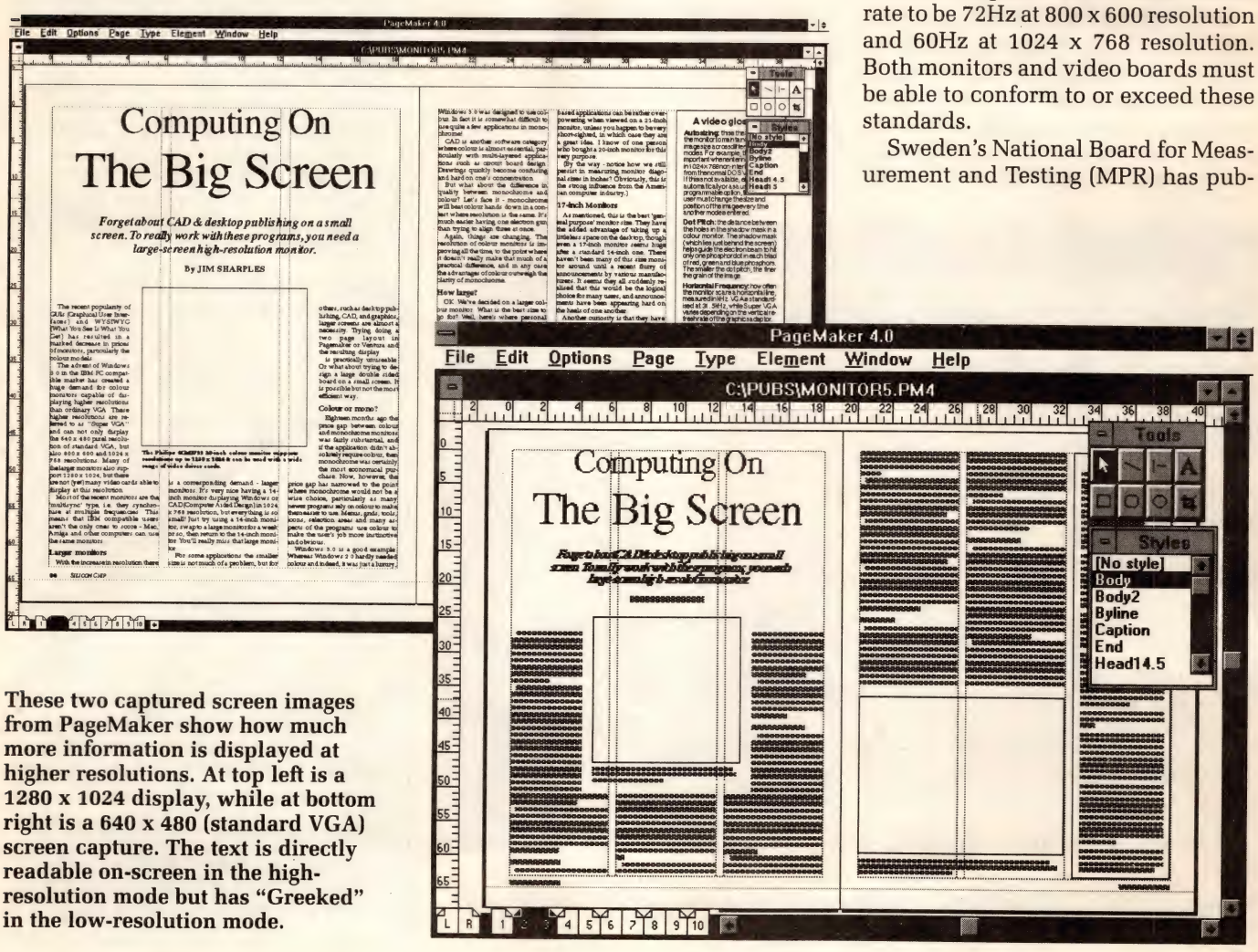
I also point out that unless they are working solely on publications where only a single page view is necessary, the portrait or 'full page' monitor can be a liability when viewing two pages side-by-side, or using other applications.

The only exception to my prejudice against portrait monitors is a rather curious animal – the Radius Full Page Pivot monitor. This colour monitor acts as its name suggests – it pivots between portrait and landscape modes, using software drivers to change the orientation when the monitor is pivoted. Portrait mode can only be used in applications for which a driver exists and these include some CAD, wordprocessing and spreadsheet programs, plus Microsoft Windows. A Mac version is also available. The Pivot measures 15-inches diagonally, so it does not really fit into the "large monitor" category.

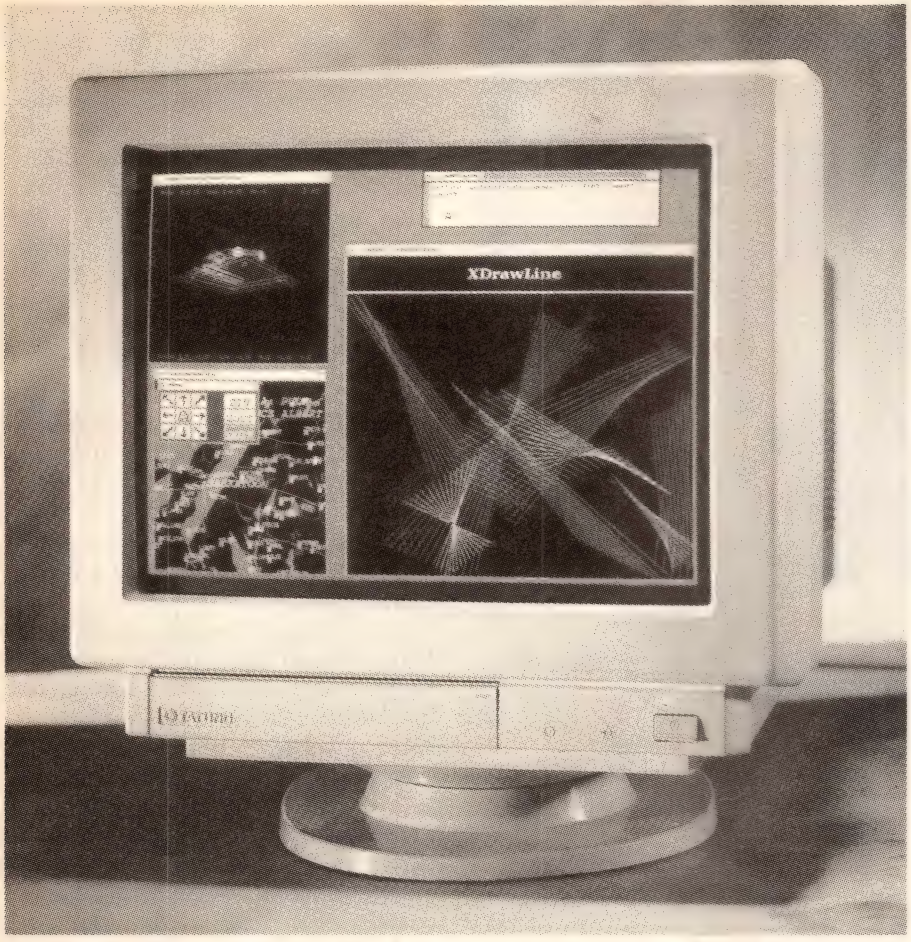
VESA & Swedish standards

The Video Electronics Standards Association has defined standards for Super VGA signals to reduce flicker. This can be particularly noticeable when the screen background is white, as in Microsoft Windows. The official standard requires the vertical refresh rate to be 72Hz at 800 x 600 resolution and 60Hz at 1024 x 768 resolution. Both monitors and video boards must be able to conform to or exceed these standards.

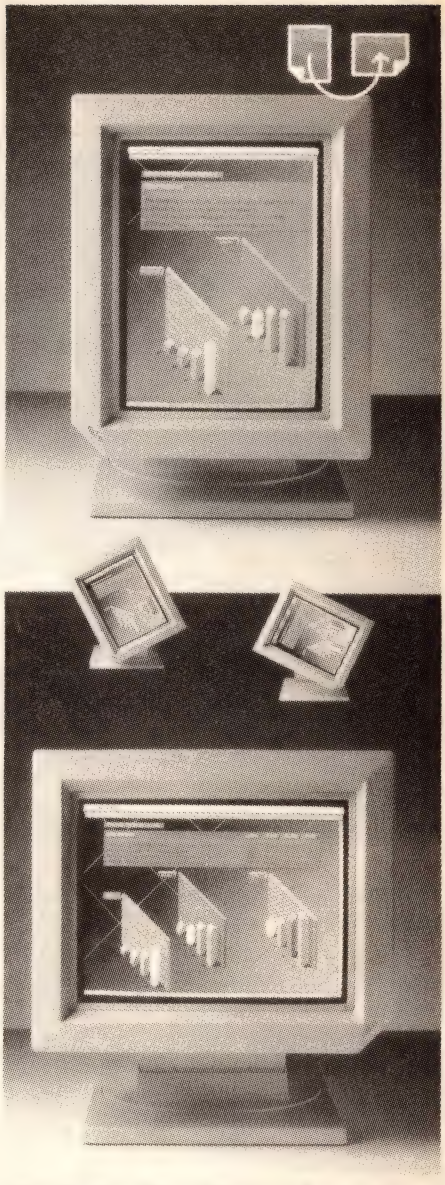
Sweden's National Board for Measurement and Testing (MPR) has pub-



These two captured screen images from PageMaker show how much more information is displayed at higher resolutions. At top left is a 1280 x 1024 display, while at bottom right is a 640 x 480 (standard VGA) screen capture. The text is directly readable on-screen in the high-resolution mode but has "Greeked" in the low-resolution mode.



A 17-inch colour monitor is a good compromise between size & cost for many applications. The multi-sync CM17MBD from Tatung features 0.26mm dot pitch, 1280 x 1024 resolution (max.), a flat dark-tinted CRT & a microprocessor-based control system for automatic screen configuration. It can be used with a wide range of driver cards for both PC & MacII computers.



The Radius Pivot Display System is a colour monitor that pivots between portrait & landscape modes to suit your application. Versions are available to suit both the PC & the Macintosh family.

lished standards for monitor emissions, designed to reduce health risks and eye stress. Many manufacturers are designing monitors to conform to the standards, though there is still some controversy over the supposed health risks.

Video graphics boards

When discussing high resolution monitors, one part of the equation that cannot be left out is the board generating the screen graphics, and here I will restrict discussion to PC compatibles. A series of simple calculations will show these results:

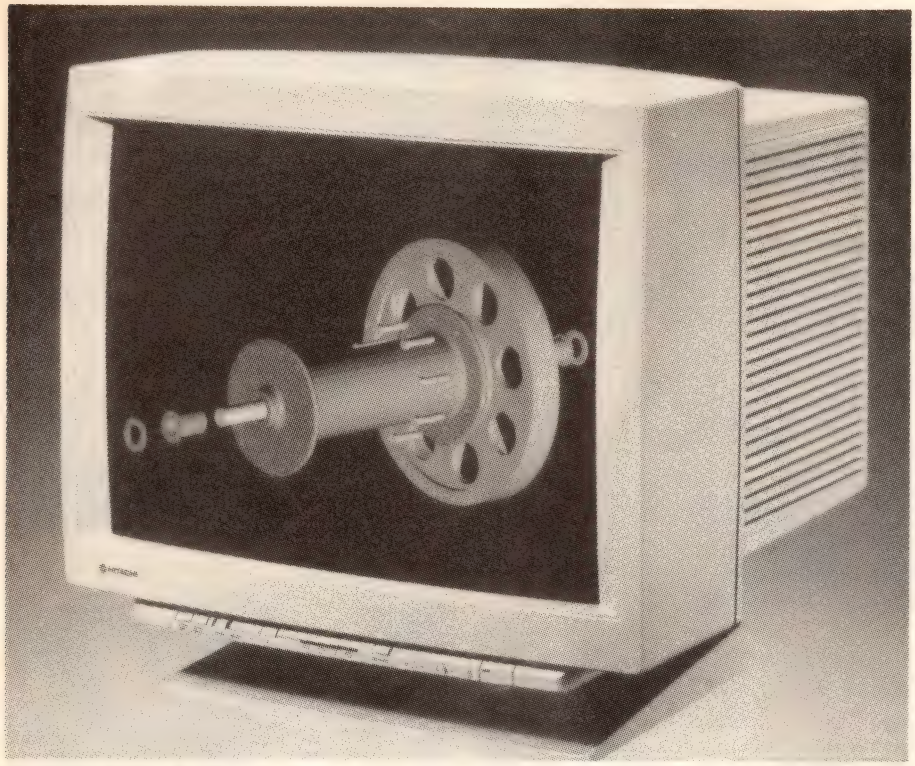
Resolution	Pixels
640 x 480 (VGA)	307,200
800 x 600	480,000
1024 x 768	789,504

It is obvious that at the common high resolution of 1024 x 768 the number of pixels is over three-quarters of a million! And the poor graphics board has to frequently redraw most of them! Standard VGA has a limit of 16 colours, whereas high resolution boards can usually generate 256 colours. This means that the high resolution board is manipulating five times as much information as VGA.

The question of which graphics board to use is therefore an important one if you want your screen updates to happen at an acceptable pace. Basically there are two types of high-resolution boards: those with graphics coprocessors and those without. The most popular and possibly fastest of the boards without coprocessors are those based on the Tseng Labs ET4000 chipset. Apart from Tseng Labs themselves, quite a number of manufacturers produce boards using this chipset.

A better option for those using large monitors at high resolutions are the coprocessor based boards. IBM initially produced the 8514/A coprocessor for 1024 x 768 interlaced resolution and others have subsequently cloned this chip, adding extended features like 1024 x 768 non-interlaced and higher scanning frequencies (see glossary for an explanation of some of the terms).

Another popular coprocessor is the Texas Instruments TMS34010 and TMS34020, and boards designed around these chips can respond to TIGA, the Texas Instruments Graphics Architecture software interface. In terms of speed, there is not much to choose between the 8514/A and



Hitachi's Model CM2187 is a 21-inch multi-sync colour monitor with a 0.31mm dot pitch & a resolution of up to 1600 x 1200 (non-interlaced). It is compatible with a wide range of graphics standards & features microprocessor control.

TMS340x0, though the 8514/A-based boards tend to be a little cheaper.

A new contender is the 86C911 chip produced by S3 Inc. The boards based on the S3 are particularly exciting, not only because of their fast speed, but because they cost about half the price of the other two types.

Most graphics boards available generate 16 and/or 256 colours (4 and 8 bits per pixel), though there are other more expensive boards available which can generate 16.8 million colours (24 bits per pixel). These boards would only entice the most demanding users who need photographic-like images and can afford the thousands of dollars required to purchase them.

There are also some lower-cost boards appearing which contain the Sierra DAC (Digital-to-Analog Converter), which is 15-bit and generates 32,768 colours, and then there are other 16-bit adapters such as IBM's XGA which generate 65,536 colours.

For most purposes, a 256-colour board based on the S3 chip would be my choice, both in terms of speed and economy.

What should you look for?

Dot pitch is important – newer 17-inch monitors are 0.26mm, while a 20-inch monitor should be 0.31mm or less.

Autosizing is a definite requirement if you will be changing modes and may be either automatic or user-programmable.

Colour-correction may be important depending on the type of work you do. The new NEC FG series is one of the few monitors available with this feature built-in.

Non-interlacing at higher resolutions can increase viewer comfort but it is important to match graphics card capabilities to that of the monitor.

Finally, spend a reasonable amount of time looking for the monitor you need and don't skimp on price and quality – you will spend long periods looking at the screen. **SC**

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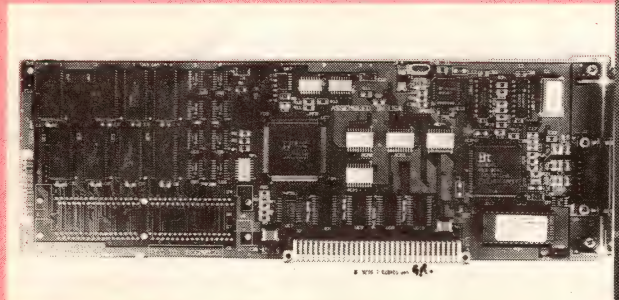
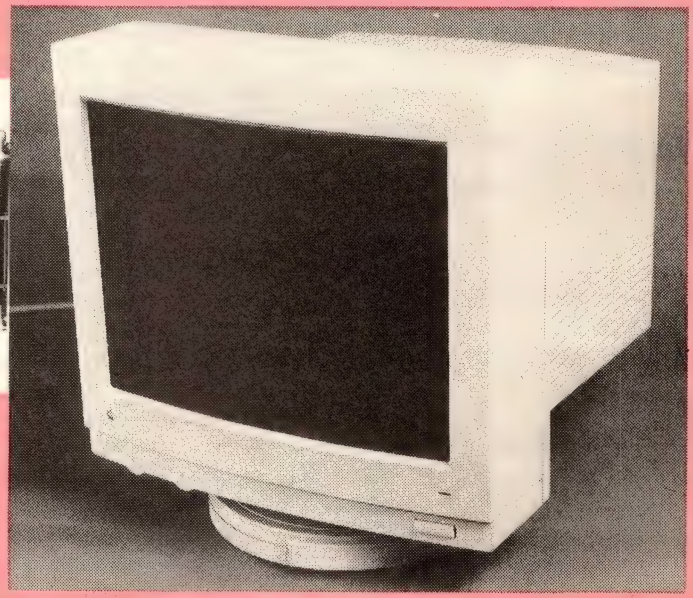
*Jim Sharples runs Computrack, a company that supplies PC-based desktop publishing equipment. Phone (02) 451 2521.

16-inch Colour Display for the Mac





Apple's new Macintosh 16-inch Color Display features 832 x 624 resolution & is supported by all current Apple video cards & by the on-board video interface of the Quadra CPUs. Alternatively, users can choose the 8.24 GC card (not needed for Quadras) which offers 32,768 colours & graphics acceleration.

Easy to build Digital Voice Recorder

A Voice recorder you can build in a afternoon

This digital voice project has hundreds of uses and will only take you a couple of hours to build. You can also install up to 4MB of RAM for longer recording times. Power is supplied from a low voltage plug pak (optional).

Low power consumption

The CMOS LSI chip used for this project uses a minimum of power. Recording and reproduction of the signals is processed through the CMOS chip using an (ADM) Adaptive Delta Modulation algorithm. This provides a clean clear recording.

An electret microphone is used, and the CMOS chip has a built-in microphone amplifier as well as a muting circuit. A 57mm speaker is provided to ensure quality reproduction. A 5mm LED is included to show the unit is recording.

Prefitted CMOS Surface mount Chip

The CMOS chip used in this kit is a surface mounted device, and so we have had these premounted to the board. The kit comes complete with a full set of instructions and 1MB of RAM.

Features:

* Voice recording and reproducing LSI using an ADM algorithm. * Capable of recording and reproducing up to a maximum of 16 phrases. * 4 different bit rates can be selected. (8K, 16K, 22K, 32K bps). * Pausing function. * Beep sound output. * Mute Circuit. * Built-in DRAM refresh circuit. * Built-in band pass filter. * Built-in microphone amplifier. * Built-in 10 bit DAC. * Built-in DAC output buffer. * Uses a 640K resonator. * +5V single power. * Clocked CMOS for low power consumption. * Variable debouncing time for start, stop and pause by the CPU terminal.

Kit $135.00

Options: UB10 Case with front & rear panels. Front Panel is punched and screened, rear is punched. $19.99 Approved Plug Pak $17.95

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This is a fully featured kit

The **Comma Fax/Modem** is a commercially designed kit you can build. It will turn your PC (or Macintosh) into both a fax machine which can transmit faxes up to 9600 baud, as well as a Modem which supports both 1200 and 2400 baud.

You get all the necessary components as well as a professional case, and power supply . You also receive **FREE** Fax/Modem software. All this for less than $300.

The **Comma Fax/Modem** uses the latest technology in digital signal processing to ensure lasting troublefree operation.

Send faxes from home

The **Comma Fax/Modem** is a fully featured fax machine *similar to units costing over $1000*, which will transmit faxes at up to 9600bp.

Your faxes can now be sent directly from your PC without having to print them first. Programs supported such as Ventura Publisher, Wordperfect, Windows, TIFF and Dr Halo to name but a few.

You can view incoming faxes on-screen or print them using a standard dot matrix printer. Incoming files can also be exported in either TIFF or PCX format for use in most popular graphic packages.

Only print the faxes you want to keep - just think of the savings on expensive fax paper.

Time saving

The **Comma Fax/Modem** will also receive faxes in background while you continue to work.

When faxing out the Fax/Modem will redial an engaged number so you can be sure your faxes are sent. The software also automatically keeps a complete log of both incoming and outgoing faxes.

Also supported are cover pages, broadcast faxes, and scheduling. The software keeps a database type register of regularly used fax numbers for easy retrieval

Note: This device does not have an Austel permit in force. Connection to Telecom lines is an offence.

ONLY $299.00

As well it's also a modem

The Comma Fax/Modem is a **fully AT command series V compatible** modem. Features include V22/V22bis standards (V21/23 is an option) both 1200 and 2400 baud rates are supported as well as auto answer, dialing and disconnect. You will find it compatible with all popular communication services including most bulletin boards.

Now Available

MNP and V42bis option. **$99.00**

V21/23 option. **$39.00**

FREE Software

With each kit you will receive the **QL2 Fax/Modem software** featuring both pull-down menus and mouse support.

Value packed kit

Each kit has been specially prepared to ensure you are able to build the **Comma Fax/Modem** with a minimum of specialised skills. We have also weighed each kit to ensure every component is included. There is also a step-by-step guide to testing your **Fax/Modem** throughout the building process.

ATTENTION: FAX/MODEM OWNERS If you own a Comma, Maestro, Interlink or other Fax/Modem and you are using the QL2 Software, then upgrade to the latest Version 2 for only $40.00 including P&P. This new version has a number of new features. Call for a Fact Sheet.

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CIRCUIT NOTEBOOK

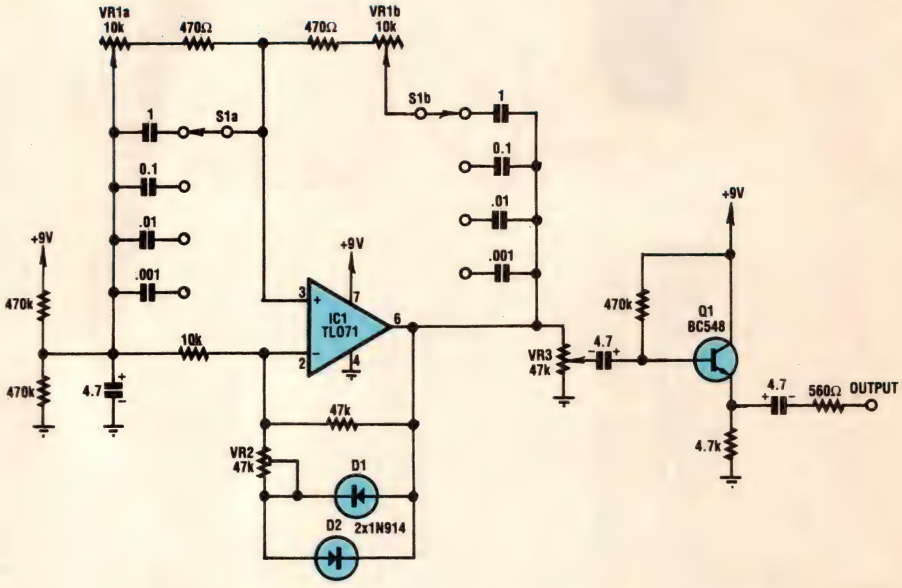
Interesting circuit ideas which we have checked but not built and tested. Contributions from readers are welcome and will be paid for at standard rates.

Low cost audio oscillator

This low cost oscillator is based on the popular Wien bridge configuration. It is powered by a single +9V supply and draws only 8mA, so it is ideal for portable, battery-powered operation. The frequency can be continuously varied over the range from 16Hz to 244kHz, with the output voltage variable from 10mV to 5V peak-to-peak over this entire range.

There are four frequency ranges, set by ganged switch S1a and S1b, with the actual frequency being set by the dual gang pot, VR1a and VR1b. The two 470Ω resistors in series with VR1 prevent the resistance from becoming too low and stopping oscillation. These components are essential to ensure that the upper frequency limit is as high as possible.

VR2 is a presettable trimpot and should be set for maximum output voltage without clipping. You will need to check the setting over each frequency range to find the best compromise.



The output is fed via VR3 which acts as a level control, before being buffered via emitter follower Q1 which provides a nominal source impedance of 600Ω.

Steven Merrifield,
Newlyn, Vic. ($25)

Bulletin board watchdog

This circuit was devised to act as a "watchdog" for a bulletin board (BBS) and to reset the computer should it "hang" for any reason. It connects across the RS-232 line and monitors DTR, TXD and CD (also known as RLSD). An IDC ribbon cable is ideal for this application, as an extra "D" connector is easily added to the line. The inputs are isolated by 100kΩ resistors so that line loading is negligible. The 1N914 diodes on the inputs prevent signal levels from going above the +5V supply rail or below 0V.

IC1b forms an oscillator which clocks a 4020 12-stage binary counter. Should the count reach a predetermined level without being reset, Q1 will be turned on, firing the 555 monostable which in turn operates Q2 and relay RLY1 which resets the computer.

Setting the 10kΩ trimpot for a clock frequency of 1Hz allows time delays of up to 34 minutes to be obtained, plenty long enough for this application.

With the computer off-line, say for maintenance purposes, the DTR lead is low and gate IC1d will be high, holding the counter chip reset. When on-line, DTR goes high and pin 11 of IC1 falls low, allowing the counter to clock. Should the computer transmit data, the TXD lead will pulse high, to be inverted by IC1c, and cause IC1d to reset the counter. Thus, while on-line with the computer sending data, the watchdog circuit is continually being reset.

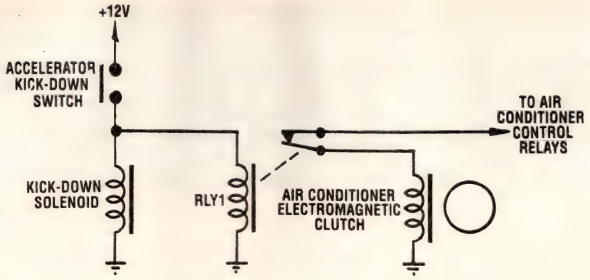
Should the computer hang, there will be no activity on the TXD line and when the counter reaches an appropriate count, the computer will be reset.

The CD/RLSD lead allows for the counter to be paused whenever the modem is communicating with another. This facility was not provided in the prototype but found to be necessary, as the BBS which it was monitoring did not send acknowledge characters when receiving large mail packets.

When waiting for a call, the BBS regularly sends a reset string to the modem, which serves to reset the watchdog and thus prevents the system from being unnecessarily reset. This usually happens every 10-15 minutes, so a "watchdog time" of 17 minutes (Q11 with 1Hz clock) was chosen. The Q12 output of the 4020 (pin 1) will give a watchdog time of 34 minutes.

Greig Sheridan,
Ashfield, NSW. ($30)

Airconditioning override with kickdown switch



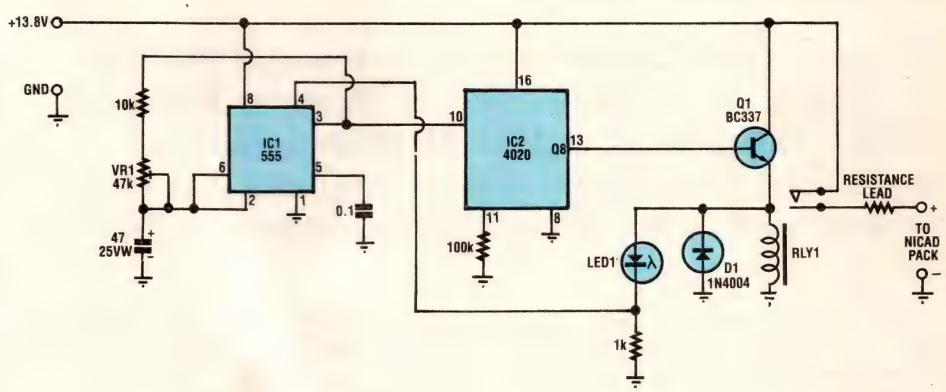
Most 4-cylinder cars with automatic transmission lack power when accelerating or overtaking with the airconditioning on. This automatic cutout is controlled by the switch under the accelerator that controls the kickdown solenoid.

The kickdown switch is used to control a relay which is placed in parallel with the existing kickdown solenoid. The relay contacts are then wired in series with the electromagnetic clutch on the airconditioning compressor. Most cars have some sort of connector harness to the clutch, so it should not be necessary to cut the clutch wires – just put connectors on the wires which run from the relay.

These wires are connected to the "normally closed" contacts on the relay, so the airconditioner runs normally during normal engine demands, but when the transmission changes down under acceleration, the compressor is temporarily cut out. The fan in the cabin continues to run, so you should not notice that the compressor has cut out temporarily.

Peter Bradstock,
Epping, NSW. ($20)

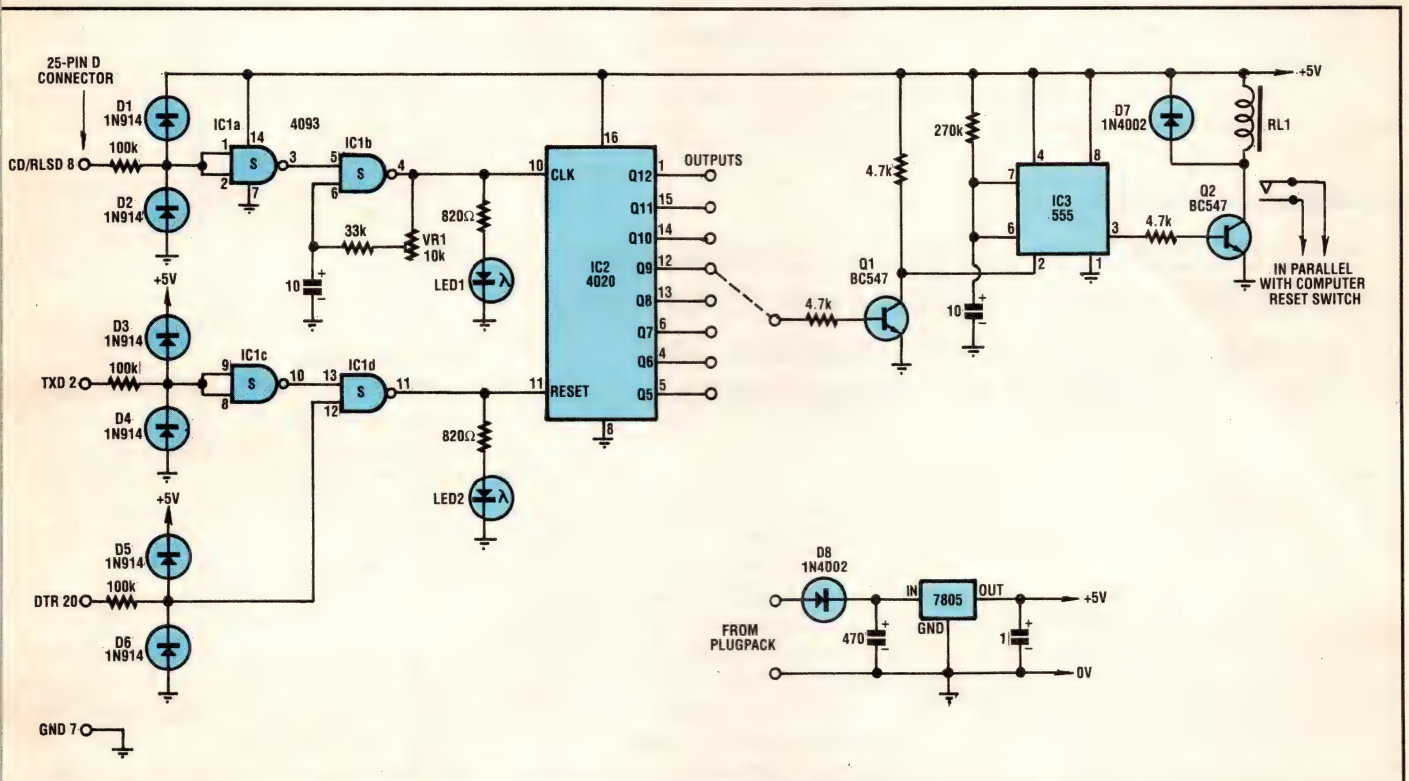
Nicad fast charger timer



This timer circuit is used in conjunction with a resistance lead for fast charging 7.2V 1200mA.h nicad racing packs from a 12V car battery. It normally takes 15 minutes to charge a battery from flat but if you then forget to disconnect it, the battery will be damaged. Mechanical timers can overcome this problem but they can jam and the result is still a ruined racing pack.

The circuit is simply a 555 timer (IC1) which clocks a 4020 timer (IC2) 256 times over a period of about 15 minutes. It then switches Q1 and RLY1 off. VR1 is adjusted to give the required period. The +13.8V supply rail is derived from the car battery.

Paul Fitzgerald,
Te Aroha, NZ. ($20)



COMPUTER BITS

BY PAUL LYNCH

The PC game is changing again: OS/2 is really here

PC users find themselves in an unusual position in 1992: IBM is really after our dollars. The year is still young but it is difficult to imagine that much will happen that's more important than the new release of the IBM operating system, OS/2.

IBM released version 2.0 of the system at the end of March. It's a true 32-bit system, which means that it runs extremely quickly.

MS-DOS and PC-DOS run at eight bits in real mode – and Microsoft Windows at best runs in only 16 bits in 386-enhanced mode. As many users have found, this higher mode of Windows is effectively no faster than the usual protected mode.

OS/2 also tackles memory management in innovative ways that make previous systems quite obsolete.

All this is good – in fact, excellent – news. But part of the news is not quite so good.

To run OS/2 version 2.0, you will need at least an 80386SX central processing unit (CPU) chip. You'll also need a lot of spare storage. The minimum requirement is 15 megabytes. If you install the lot, it will occupy 30Mb of your hard disc. So if you already have a machine with a 40Mb hard disc, it's quite likely that OS/2 is not for you – at this time.

What we have now is software that in effect will prescribe your hardware configuration – if you choose to accept it. What IBM has done to encourage you to do this is really quite remarkable.

The nature of SILICON CHIP is pretty obvious – it's a technical magazine. But at some stage, the PC user looking for software must recognise the commercial environment in which he or she is operating. There are many dead ends in the history of the PC: I have a number of software packages on my shelves that I seldom used some years ago and will never use again. They've been a waste of money – quite a lot of it, I'm sorry to say. They remind me daily of the importance of looking beyond the technical parameters when buying major software and equipment.

"To run OS/2 version 2.0, you will need at least an 80386SX central processing unit (CPU) chip. You'll also need a lot of spare storage. The minimum requirement is 15 megabytes"

The new version of OS/2 is quite wonderful but a straight technical statement of its characteristics will not answer the sensible questions of most users. After all, to run it, many people must consider replacing their present computer at a cost of some thousands of dollars. Is this a good idea? Answering the question calls for a quick stroll through the marketplace.

The race for our dollar

Quite a lot of the stuff laid out in the market is there not because it's ready, but just to beat a competitor in the race for our dollar.

Central Point Software and Symantec had just such a race last year – Central Point was in a hurry to put PC Tools 7.0 on the market, because Symantec was in a hurry to present Norton Utilities 6.0. Haste overcame caution and within weeks of each other, both manufacturers found it appropriate to bring out free updates designed to fix the errors that existed in the products as first marketed. Central Point issued PC Tools 7.1 and Symantec offered 6.01.

The feelings of people who purchased the bug-infested versions only weeks or months earlier have not been recorded publicly. But in a recent article in the American magazine *PC Computing*, senior officials of WordPerfect were quite frank about the error they'd made in putting their version 5.0 on the market too soon a few years ago. As they see it now, the product had so many glitches that it almost destroyed their reputation. (It's worth recalling that it's only in the past few months that WordPerfect re-

leased its Windows version – two years behind its major competitors).

Beyond this urge to hit the market at the earliest possible date, all software manufacturers find themselves to a large extent in the fortune-telling business. What do we users want? What will we pay for? How much of what we want should be in the final package? WordStar users saw what started out as a single double-density disc program wind up, in version 5.5, as one that needed 19 discs for the same program with all kinds of bells and whistles. I doubt that any single user wanted, or applied, all the wonderful things offered on those 19 discs but the manufacturer had a commercial need to supply the lot.

Since 1990, software manufacturers have had another question to answer: when they move beyond MS-DOS, should they develop a Windows version or an OS/2 version? OS/2 was clearly a technically superior interface but market realities are such that many of those software designers who decided that OS/2 was the way to go got their fingers burned quite badly.

While OS/2 had been round since 1987 as a joint effort between Microsoft and IBM, there was a rupture of the partnership. Microsoft pulled out because of the staggering success, starting in 1990, of its graphics interface, Windows.

The success of Windows

In any history of the PC, the appearance of Windows 3.0 will merit a new chapter. Earlier versions of the program were glitch-ridden, and even 3.0 presented users with some difficulties, but largely due to the support of other software manufacturers who wrote programs to operate through MS-DOS plus the Windows 3.0 graphics interface, the Windows market exploded.

Over nine million copies had been sold by the end of 1991. This is why Microsoft says "the market has spoken", suggesting that computer users are so happy with their product that they want, or will want, no other.

This is a doubtful proposition. But the Windows success prompted Microsoft to pull out of OS/2 development and concentrate on later versions of Windows. Version 3.1 came out last month and Windows NT – a 32-bit package – is promised for late this year. Presumably, NT will be the first true Windows operating system, as distinct from an add-on to the basic MS-DOS: which is what versions 3.0 and 3.1 are.

Microsoft says that no matter which version you buy, it will always look like what you're used to. The present Windows interface will always be retained – as far into the future as its technical people can see.

So why should users buy OS/2 version 2.0 instead of sticking with Windows? There are a few reasons. The first and most dramatic is probably that OS/2 actually includes Windows 3.0 and IBM promises that it will continue to enhance its Windows versions in the package – to match 3.1 and, later, to match NT.

How is this possible? It's because IBM and Microsoft signed a development deal for graphic interfaces back in the eighties that gave IBM full rights to all programming codes developed during the course of that agreement. This agreement runs as far as the coming Windows NT, IBM claims, and includes it.

So if you like Windows, and want to use it, you now have a choice of buying the Microsoft version or the IBM version. If you buy Microsoft, you will also need to buy MS-DOS, on which Microsoft Windows stands. If you buy OS/2 version 2.0, you will find it includes DOS – and goes beyond it into 32-bit processing.

Countless forests have been hewn to bring computer users the first reports on what OS/2 is, and what it does. Here is a simple Q&A that answers some questions about whether it belongs in your computer – now, or in the future.

What's the minimum hardware I'll need for OS/2?

IBM says this is an 80386SX with 60Mb of storage and 4Mb of RAM. A smaller hard disc may suffice if you are running compression-on-the-fly – such as SuperStor, Stacker or DoubleDisk. Obviously, the faster your CPU chip, the greater your RAM and the larger your hard disc, the better OS/2 will run.

How much disc space will I need?

The bare-bones installation occupies 15Mb and there are alternative installations that take you up to 30Mb. The higher-end installations, however,

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are those including the on-line help, and if you don't have this, your learning curve may be a longer one.

How much does it cost?

Beats me. The recommended retail price is $275 but you could get it for about $250 on the day it hit the shops. IBM is apparently interested in discounting to get a leg into this market which ultimately can bring them hundreds of millions of dollars.

How well does it work?

Brilliantly. An IBM publicist said last year that the new package would "run DOS better than DOS and Windows better than Windows". OS/2 certainly does that, for two reasons. One is that it's a 32-bit package – your DOS and Windows applications run faster. The other is that IBM, just like Microsoft, has had about two years to clean up some of the things that troubled Windows users with the 3.0 package. I couldn't get any Unrecoverable Application Errors from my OS/2 Windows, for example. Memory management is wonderful.

I don't use Windows and don't want to. What's in OS/2 for me? Quite a lot of things. Your DOS programs will run faster. RAM cram vanishes because of the way OS/2 presents DOS – which is that it sets up a new DOS simulation for every DOS program you get into. These simulations each have something like 630Kb of available RAM. Task switching is better. The REXX programming language supplied is better. And besides, OS/2 is bundled with a lot of things beyond the operating system itself.

And these are?

There's a database and a spreadsheet. There's a good communications program for modem users. There's a calendar/diary/personal information manager. There are excellent games. There's a 5-disc suite of device drivers, including scads of mouse drivers. There's a type-font program. (These are just the things I found in my review copy. I'm told there's more).

Are any OS/2 application packages in the market?

Yes. In June last year, you could buy PageMaker, CASE, Corel Draw, Lotus 1-2-3, PackRat, Ventura, WordPerfect and other packages in OS/2 versions. Microsoft was offering Excel and Word. IBM spread its programming codes around for version 2.0, and now claims that 800 applications are now available or in advanced preparation. Note, by the way, that the programs listed here sold for the same prices as the Windows versions in almost every case.

Is OS/2 here for the long haul?

We don't know whether any of the current systems are here for the long haul. How long a haul are we thinking of? It's pretty obvious that OS/2, DOS and Windows are here for as long as we're using x86 Intel CPUs. And IBM has already worked out how to transfer our OS/2 data files to RISC processors. Only a brave or foolhardy person would predict what CPUs we'll be using 10 years from now.

"OS/2 actually includes Windows 3.0 and IBM promises that it will continue to enhance its Windows versions in the package – to match 3.1 and, later, to match Windows NT"

How confident can I be that OS/2 works?

Pretty confident. IBM issued 30,000 beta copies before release and licensed many of the beta assessors to make up to 10 copies of the beta code. When Microsoft released MS-DOS 5.0 last year, it announced there had been 5000 beta testers – at that time, the largest such program in history. DOS 5.0 doesn't seem to have too many dark and spooky corners.

Do I really need OS/2?

It's up to you. If you often sit in front of your computer waiting for it to do things, for example, you'll spend less such time with OS/2. If you're crashing your present system often, you should enjoy less crashes under OS/2, because of the improved memory management.

If you foresee working with any software that calls for a lot of calculation, you can rest assured that somebody out there is writing or bringing to market a 32-bit version that won't run under DOS. If you're already running a program you want to be faster, check with your program's Australian agent when the OS/2 version will be available. Your DOS or Windows software will be faster within OS/2; your OS/2 application will be faster again: in some cases, much faster.

What are the disadvantages?

The main one, is that you have to learn it. It's not much fun learning any new software. One of the many charms of Microsoft Windows is that its Program Manager interface slashes the learning time for new applications; but you have to learn the PM interface before you can take advantage of this. In exactly the same way, you have to learn how OS/2 works.

The other disadvantage is the high hardware requirement. You may not be able to run OS/2 at all on your present computer. Then again, you may not be able to run Windows NT, either.

How do you see OS/2?

My view is that it shows us where the PC is going. Not everybody has to follow this path. If you want a simple business machine for word processing, plus a couple of simple DOS and Windows programs, you can continue happily with an 80286 machine, a couple of megs of RAM, and a 20-40Mb hard disc. These machines are really cheap today and will get cheaper in the future.

OS/2's ability to run DOS and Windows now, and keep up with Windows even through the NT evolution, is a powerful incentive to adopt the system. And the higher-level machines are also getting cheaper.

Coincidentally, just as I was finishing this column, I saw a newspaper advertisement from a well-known clone supplier. It was for an 80486-40 machine with 64Kb RAM cache, 125Mb hard disc and 4Mb RAM – for under $2200. Two years ago, an 80286 with a 40M hard disc, no cache and 2Mb of RAM, could cost you $5000 or more. **SC**

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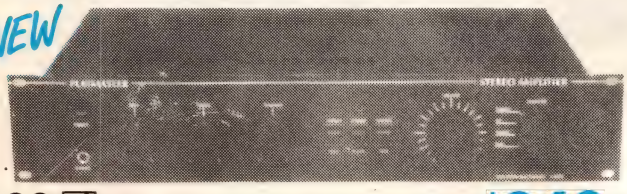

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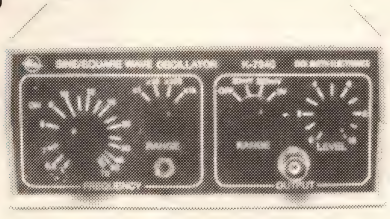

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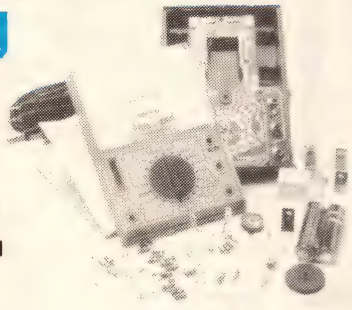

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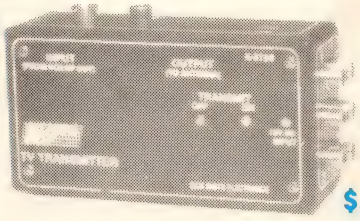

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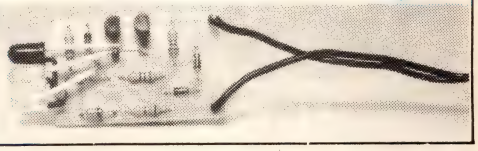

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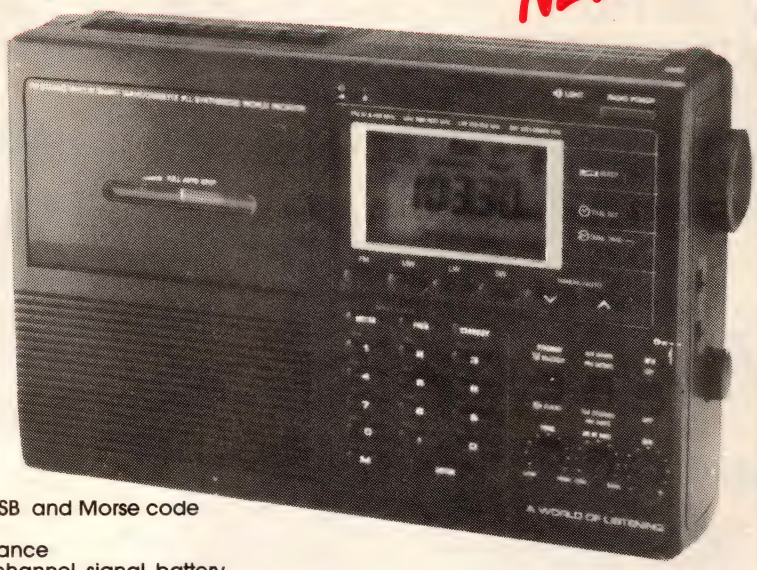

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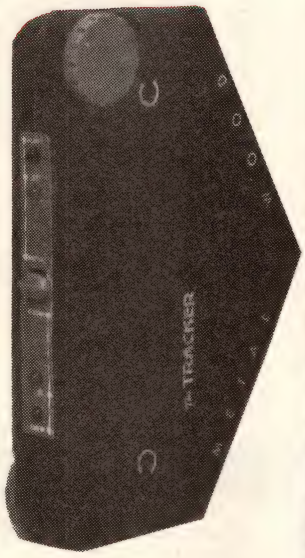

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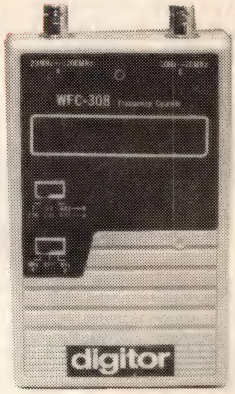

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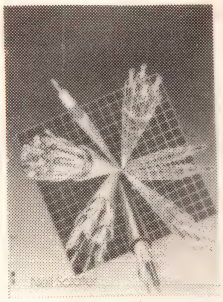

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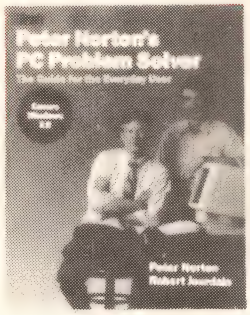

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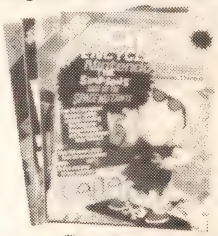

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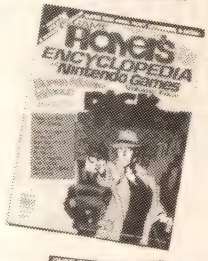

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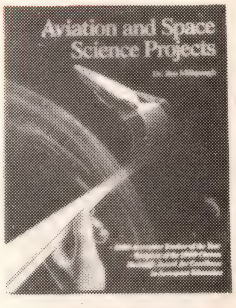

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DICK SMITH ELECTRONICS

B1316/LB

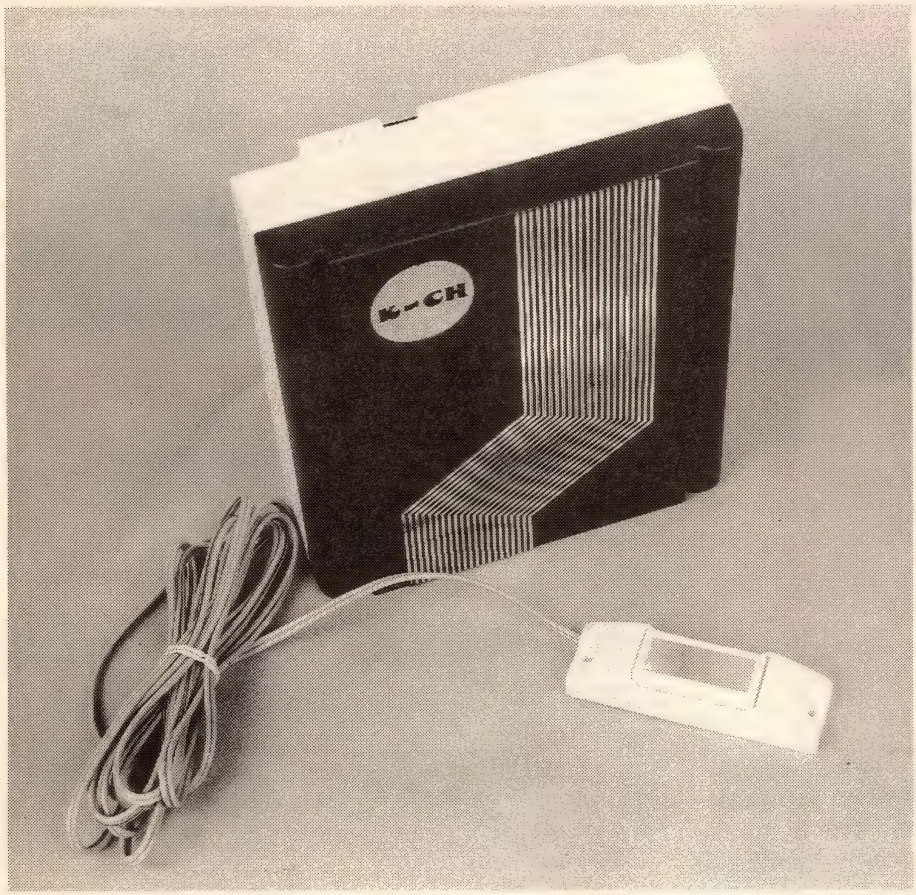
A low-cost electronic doorbell

Has your doorbell broken down? This unit uses readily available parts to produce a realistic & pleasant "dinggg-donggg" sound.

By DARREN YATES

These days, like most consumer goods, doorbells are treated as a "throw-away" item – the cost of repairing one invariably exceeds the cost of buying a new one. If your doorbell has broken down or if you don't already have one, then here's an ideal opportunity to build a deluxe unit for yourself.

As you can see from the photographs, we built two versions, one housed in a commercial doorbell case (from Dick Smith Electronics) and the other in a plastic zippy box. Apart from that, the two units are identical. Go for the Dick Smith Electronics version if the unit is to be seen as well as heard.



In other situations, the zippy box version may be the more convenient, particularly if the unit is to be hidden from view on top of a cupboard or a bookcase.

The last time that we used a 2-tone chime circuit was in the Door Minder project, published in February 1988. That circuit used an SAB0602 2-tone chime IC which has subsequently become hard to get and expensive.

This project overcomes that problem by using common CMOS ICs. In fact, parts of the circuitry are similar to the Executive Thingie project in last month's issue.

When the front doorbell switch is pressed, this project generates the familiar "dinggg-donggg" sound by sequentially feeding the outputs from two tone generators to a small power amplifier. These tone generator outputs are fed to the amplifier via separate CMOS FETs which act as variable resistors to give the required decay characteristics.

Power is derived from a 6V battery pack consisting of four 1.5V AA cells. If you use alkaline types, they should last for about one year or so. Alternatively, you could replace the batteries with a 6V 300mA plugpack and forget about them.

Block diagram

Refer now to Fig.1 which shows the block diagram of the Doorbell. We'll

Left: this view shows the completed electronic doorbell in the commercial case that's available from Dick Smith Electronics. This case has a dark brown front panel with metallic highlights and this attaches by four screws to a cream-coloured mid-section. The rear-panel, which is moulded in black plastic, is secured to the wall and the front assembly then clips over it.

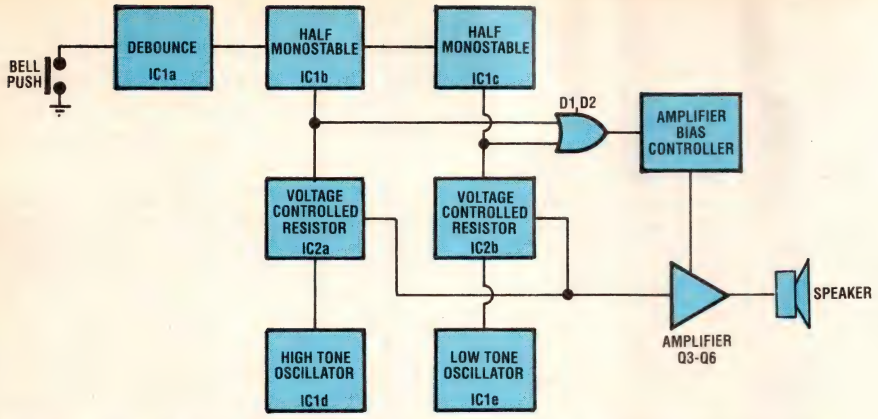


Fig.1: when the doorbell switch is pressed, the two half monostable stages (IC1b & IC1c) are activated in sequence & apply bias to voltage controlled resistor stages IC2a & IC2b. These stages then modulate the outputs from the tone generators (IC1d & IC1e) & the resulting signals are then fed to an audio amplifier stage (Q3-Q6).

just go through it briefly at this stage, so that you will understand the basics of the circuit.

The front doorbell switch is connected to a debounce circuit based on IC1a. This prevents false triggering due to switch contact bounce or due to spikes generated in the switch leads by nearby lightning strikes or mains transients.

From there, the output is then fed into two half-monostables based on IC1b and IC1c. These provide the correct time delay between the two tones of the doorbell.

Each half-monostable is connected to a voltage-controlled resistor network (IC2a & IC2b) and these modulate the outputs from tone oscillator stages IC1d & IC1e to give the characteristic ringing sound. The outputs from the voltage controlled resistor stages are then fed to the audio amplifier stage (Q3-Q6) and to the loudspeaker.

We've pulled rather a neat trick with the audio amplifier stage, however. Because the circuit is powered continuously, we have to make the quiescent current (ie, the current flow when the circuit is in its idle state) as low as possible, to conserve the batteries.

By using CMOS ICs in the front end, we have no problems here but we have to control the quiescent current of the audio amplifier. The easiest way to achieve this is to use the half-monostable outputs to control the DC bias of the amplifier via an OR gate (D1 & D2).

When the circuit is in its idle state, the monostable outputs are low and no forward bias is applied to the amplifier. Thus, the quiescent current drawn by the audio amplifier is reduced to zero. Conversely, when either half monostable output is high, the output of the OR gate is also high and bias is applied to the amplifier which then operates as normal.

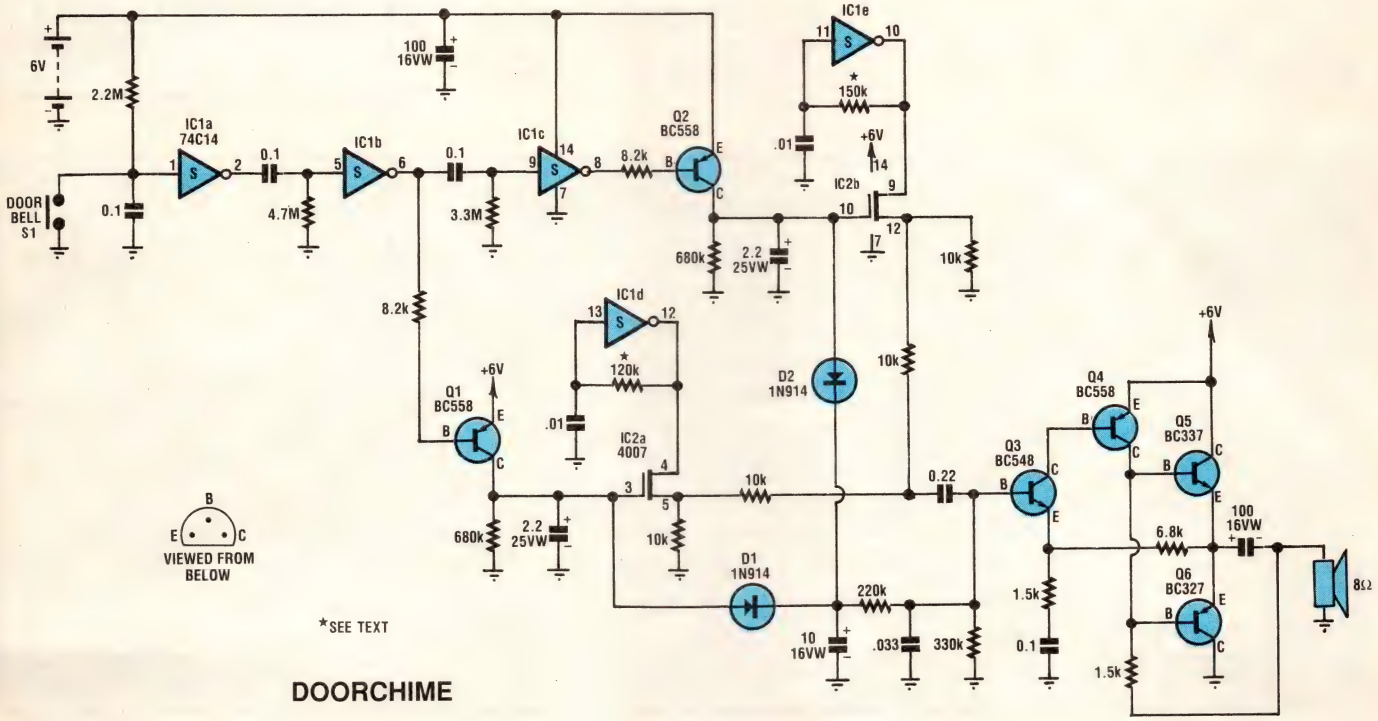
This allows us to keep the quiescent current down to only 160µA. Not bad, huh?

Circuit diagram

Let's look now at Fig.2 which shows the complete circuit details. The project is based on two common CMOS ICs and six transistors.

Let's start again with the doorbell

Fig.2 (below): the final circuit uses the FETs from a 4007 IC as the voltage controlled resistors. When S1 is pressed, Q1 turns on & provides bias to IC2a which allows through signals from oscillator stage IC1d. Q1 then turns off & Q2 turns on to provide bias for IC2b which then passes signals from tone oscillator IC1e.



DOORCHIME

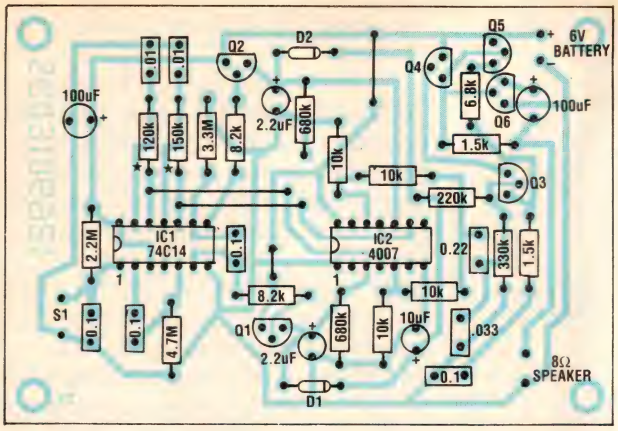


Fig.3: you can install the parts on the PC board in any order but take care with the orientation & placement of the transistors & ICs. The two resistors marked with asterisks may need adjusting to get the correct tones.

switch. The 2.2MΩ resistor, the 0.1µF capacitor and Schmitt trigger stage IC1a form the debounce circuit. These components clean up the waveform produced by the bouncing switch contacts to give a positive-going pulse on pin 2 of IC1a each time the switch is pressed.

This positive-going pulse is then AC-coupled to the first of the half-monostable stages. This stage consists of IC1b and its associated 0.1µF capacitor and 4.7MΩ resistor.

Normally, pin 5 of IC1b is held low by the 4.7MΩ resistor and so its output at pin 6 is high and transistor Q1 is off. When pin 2 of IC1a switches high (ie, when the doorbell is pressed), IC1b is immediately triggered and switches its pin 6 output low. Pin 6 of IC1b then switches high again a short time later on the trailing edge of the input pulse, as set by the RC time constant on pin 5.

When pin 6 of IC1b goes high again, the second monostable based on IC1c is triggered into action. This half-monostable works in exactly the same manner as the first and switches its pin 8 output low for a brief period.

Thus, the two half-monostables work in a sequential fashion, with IC1b first briefly switching its output low and then IC1c doing the same.

Voltage-controlled FETs

Transistors Q1 and Q2 buffer these outputs and in turn drive the voltage controlled resistor stages IC2a and IC2b. These stages are actually the N-channel FETs from two complementary pairs inside a 4007 CMOS IC.

When pin 6 of IC1b switches low, Q1 turns on and quickly charges the 2.2µF capacitor on its collector. This turns on N-channel FET IC2a by pulling its gate (pin 3) high, so that it now passes signal from tone oscillator stage IC1d.

When pin 6 of IC1b switches high again, Q1 turns off and the 2.2µF capacitor discharges via its parallel 680kΩ resistor. This sets the decay time for the tone oscillator signal. As the voltage across the 2.2µF capacitor decreases, the source-drain resistance of the FET increases so that the signal level on pin 5 decays to zero.

Q2, IC2b & IC1e operate in exactly the same fashion. When Q1 turns off, Q2 immediately turns on and this turns on IC2b which now passes signal from tone oscillator IC1e.

The two tone oscillators (IC1d & IC1e) are standard Schmitt trigger configurations with RC feedback components. IC1d is the high tone oscillator and IC1e is the low tone oscillator. Or, to put it another way, Q1, IC1d and IC2a produce the "ding", while Q2, IC1e and IC2b produce the "dong".

Output amplifier

The tone outputs from the FETs are mixed via two 10kΩ resistors and coupled to the base of Q3 in the audio amplifier via a 0.22µF capacitor. A .033µF capacitor then filters the waveform on Q3's base to give it a more "mellow" sound.

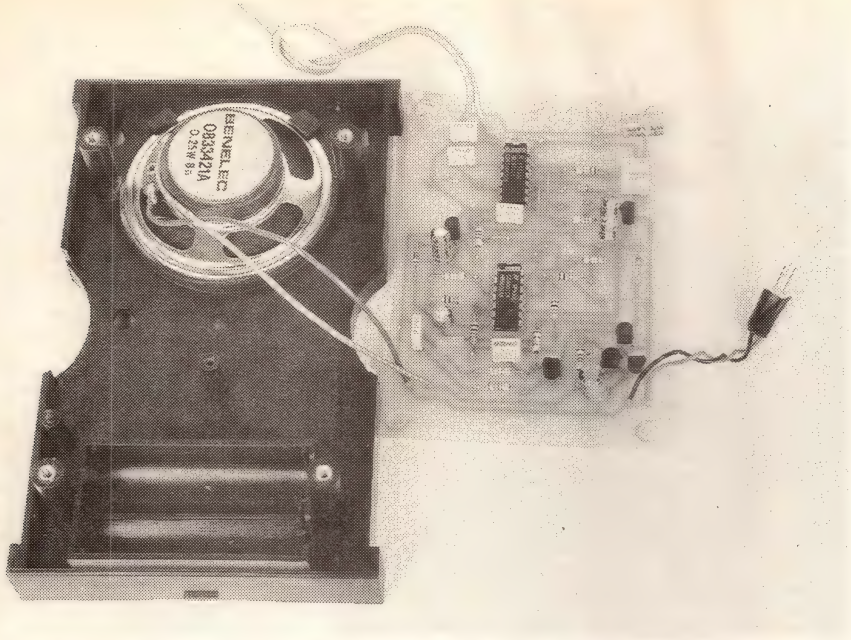
The audio amplifier is a fairly standard 4-transistor class B arrangement but note that no fixed bias is applied

CAPACITOR CODES (10%)

❑	Value	IEC Code	EIA Code
❑	0.22µF	220n	224K
❑	0.1µF	100n	104K
❑	.033µF	33n	333K
❑	.01µF	10n	103K

RESISTOR COLOUR CODES

❑	No.	Value	4-Band Code (1%)	5-Band Code (1%)
❑	1	4.7MΩ	yellow violet green gold	not applicable
❑	1	3.3MΩ	orange orange green gold	not applicable
❑	1	2.2MΩ	red red green gold	not applicable
❑	2	680kΩ	blue grey yellow brown	blue grey black orange brown
❑	1	330kΩ	orange orange yellow brown	orange orange black orange brown
❑	1	220kΩ	red red yellow brown	red red black orange brown
❑	1	150kΩ	brown green yellow brown	brown green black orange brown
❑	1	120kΩ	brown red yellow brown	brown red black orange brown
❑	4	10kΩ	brown black orange brown	brown black black red brown
❑	2	8.2kΩ	grey red red brown	grey red black brown brown
❑	1	6.8kΩ	blue grey red brown	blue grey black brown brown
❑	2	1.5kΩ	brown green red brown	brown green black brown brown



The PC board is secured to the rear panel of the DSE case on 25mm tapped standoffs. Note that the 100µF capacitor at top right is mounted with its body flat against the PC board so that it clears the loudspeaker.

to Q3 or to the complementary output pair (Q5 & Q6). Q3 is wired as a common emitter amplifier and provides most of the voltage gain. Its collector output drives Q4 which in turn functions as a driver stage for Q5 and Q6.

Note that the bottom end of Q6's 1.5kΩ base bias resistor has been connected to the output rather than to ground. Because Q5 and Q6 together function as an emitter follower with a voltage gain of almost unity, there is almost no AC voltage across the 1.5kΩ resistor. This means that very little signal current flows in the resistor and thus its impedance does not load the output of the preceding stage, Q3.

This technique is called "bootstrapping" and it results in greater signal output.

The gain of the amplifier is set to approximately 4.5 by the ratio of the 6.8kΩ and 1.5kΩ feedback resistors. The amplified audio signal appears at the emitters of Q5 and Q6 and is coupled to the loudspeaker via a 100µF capacitor.

Bias control

The DC bias control circuit for the amplifier is quite simple but very effective in reducing the quiescent current to zero under no-signal conditions. As mentioned earlier, it is based on diode OR gate D1 and D2.

This OR gate drives a voltage divider consisting of 220kΩ and 330kΩ resistors. The voltage developed at the junction of this voltage divider then provides the DC bias for the audio amplifier. Let's see how it works.

When S1 is pressed, Q1 immediately turns on as described previously and pulls D1's anode high. Thus, the output of the diode OR gate also goes high and this applies approximately 3.2V of DC bias to the base of Q3 via the voltage divider.

Similarly, when Q1 turns off and Q2 turns on, the output of the OR gate is pulled high via D2 and base bias is applied to Q3 as before.

When the output of the OR gate subsequently goes low (ie, at the end of the two tones), the 10µF capacitor immediately begins discharging via the 220kΩ and 330kΩ resistors. This progressively removes the DC bias from Q3 over a 5-second period, thus effectively shutting the amplifier down until the button is pressed again.

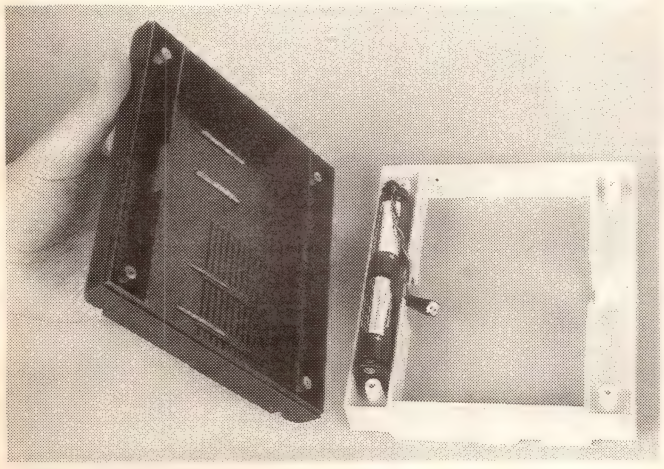
By the way, if the doorbell switch is pressed and held down, the Doorchime will only operate once and then stop. That's because IC1b can only be triggered when pin 2 of IC1a switches from low to high (ie, the change of state is necessary to trigger IC1b).

Thus, to get the Doorchime to sound repeatedly, it is necessary to repeatedly press the doorbell switch.

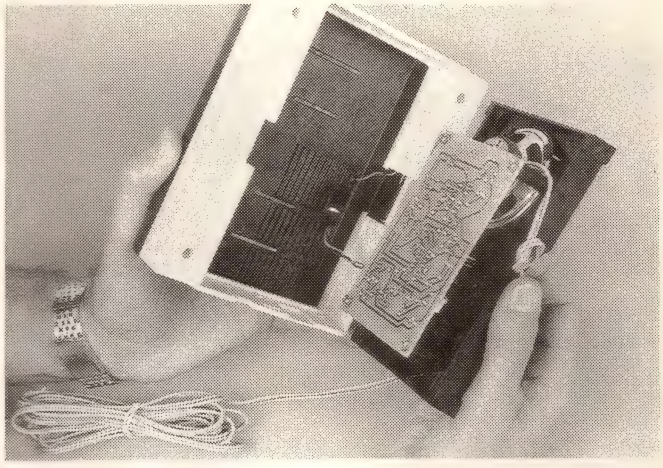
Board assembly

Fig.3 shows the parts layout on the PC board. This board is coded SC03-106921 and measures 108 x 74mm.

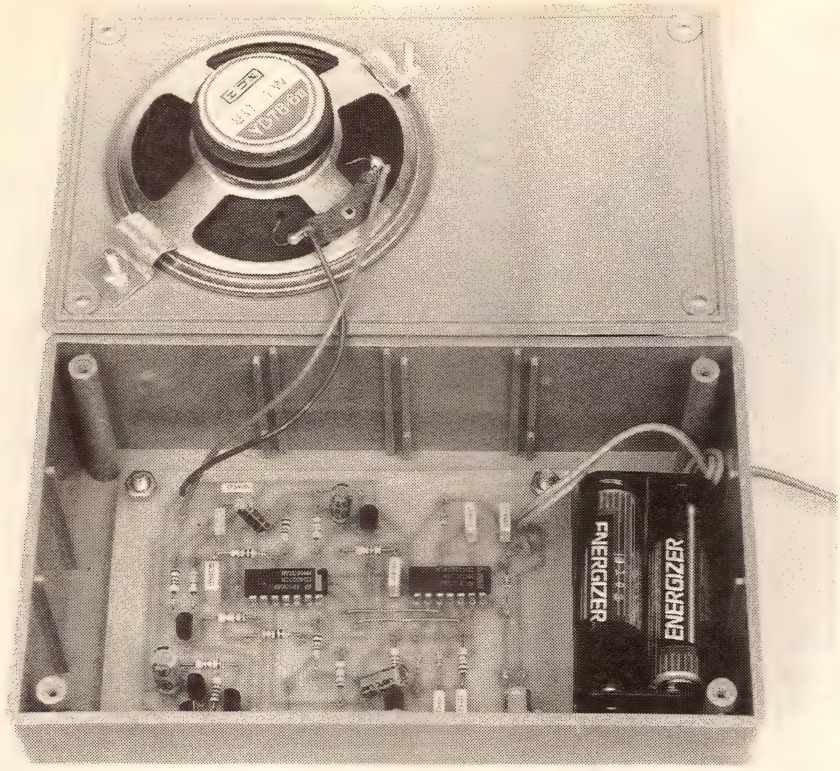
Before starting the assembly, check



This view shows how the batteries are hidden in one channel of the DSE case. The front & mid-sections of the case are held together by four self-tapping screws.



The four plastic ribs on the back of the front section must be snapped off before the final assembly, to provide clearance for the PC board.



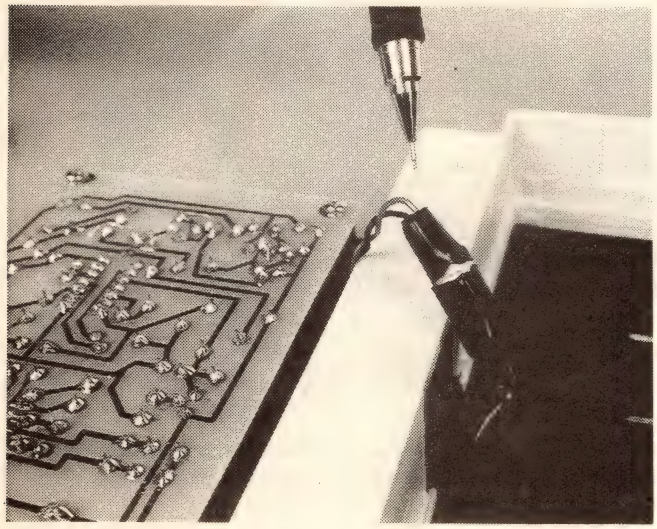
A plastic zippy case can be used to house the PC board if the unit is to be hidden out of sight (eg, on top of a cupboard or bookshelf).

the board carefully by comparing it with the published pattern. If you find any defects, correct them immediately, then install the four wire links. Make sure that the links are straight, so that they don't short against other parts.

Once the links are in, you can install the resistors, diodes and capacitors. The two resistors marked with asterisks should be soldered to PC stakes and not directly to the board itself. This makes it easy to make adjustments to the tone oscillators, as we'll explain later.

The accompanying table shows the resistor colour codes but it's also a good idea to check them on your multimeter before installing them on the PC board. Make sure that the diodes and electrolytic capacitors are correctly oriented.

Finally, you can complete the board assembly by soldering in the ICs and the transistors. Be sure to use the correct transistor type at each location, as both NPN and PNP types are used in the circuit. Fig.2 shows the pin connection details for the transistors.



Install a plug and socket in series with the battery leads if you are using the DSE case, so that you can easily separate the front section from the rear panel assembly. This will make it much easier to replace the batteries when they eventually go flat.

Now for the big test. Connect the loudspeaker, bell push (S1) and battery connector to the PC board, then snap the battery into position. If everything is OK, the circuit should trigger immediately power is applied.

After that, you will have to press S1 to trigger the unit – disconnecting and reconnecting the battery will not do the job unless you discharge the 100µF filter capacitor across the supply.

Adjusting the tones

At this stage, the tones might sound a bit "wonky" but that's easily fixed by changing the values of the feedback resistors in the tone oscillators (ie, those marked with asterisks). You simply increase the resistor values for lower tone frequencies and decrease them for higher frequencies.

For example, to lower the frequency of the "dinggg", increase the value of the 120kΩ feedback resistor in the high tone oscillator.

If you're the cautious type, then connect your multimeter (set to the mA range) in series with one of the battery leads before initially applying power. It should indicate a peak current of about 40mA as the doorbell sounds, but this should then rapidly fall away to about 160-170µA after 10 seconds or so.

If you get any readings other than these, (eg, if you get a current of 40mA or more continuously), switch off immediately and check for wiring errors. In particular, check for incorrectly oriented parts and for shorts on the copper side of the board (eg, shorts between adjacent IC pads).

Final assembly

Once the circuit is working correctly, you can install it inside the case. If you're using a plastic zippy case, first attach the adhesive label to the front panel and drill out a pattern of 5mm-diameter holes to let the sound escape from the loudspeaker (note: drill small pilot holes first).

The loudspeaker can then either be glued in position or secured to the lid using two small aluminium brackets, machine screws and nuts (see photo).

The PC board is mounted on the bottom of the case at one end, so that it sits underneath the loudspeaker. Check that there is enough room at the other end of the case for the batteries before drilling the mounting holes.

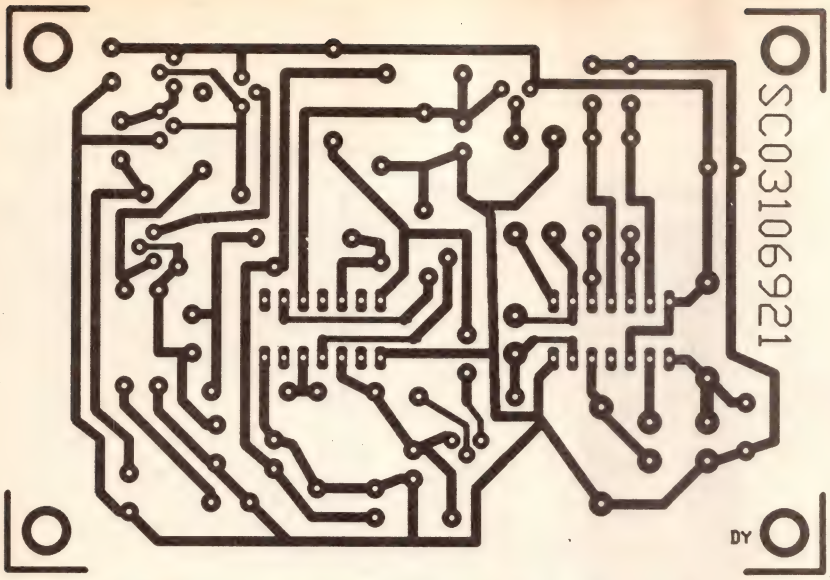


Fig.4: this is the full-size etching pattern for the PC board (code SC03106921).

The board can then be mounted in position on 5mm spacers and secured using screws, nuts and star washers.

The assembly can now be completed by drilling a small exit hole in the side of the case for the leads to the doorbell switch. These leads can be made as long as is necessary to connect the unit and doorbell switch together.

The alternative Dick Smith Electronics case is a 3-piece assembly of moulded plastic. The front piece is dark brown with metallic highlights and this attaches by four screws to a cream-coloured mid-section. The rear-panel, which is moulded in black plastic, is secured to the wall and the front assembly then clips over it.

If you're using the Dick Smith Electronics case, it's simply a matter of gluing the loudspeaker into the mould on the rear panel and mounting the PC board over it on 25mm-long plastic standoffs. These standoffs are mounted on either side of the loudspeaker and the moulded battery holder (see photo).

Don't forget to connect the loudspeaker leads before mounting the PC board with its code number adjacent to the loudspeaker.

The zippy box version has a series of 5mm-diameter holes drilled in the front panel to allow sound to escape from the loudspeaker.

Battery arrangement

The battery holder moulded into the rear panel is not used here. Instead, the batteries are clipped into a separate long holder which is cleverly hidden in one of the channels that run down both sides of the case. You gain access to these channels by undoing the four screws that hold the front and middle sections together. The battery holder is installed in the righthand channel, as viewed from the back, and the leads passed out through the cutout in the centre of the channel.

By the way, it is a good idea to install a plug and socket in series with the battery leads so that you can easily separate the section containing the batteries from the rear panel assembly. This will make it much easier to replace the batteries when they eventually go flat.

Finally, it is necessary to remove four plastic ribs from inside the case before clipping it over the rear panel assembly. These ribs can be easily snapped off by hand. **SC**

PARTS LIST

1 PC board, code SC03106921, 108 x 74mm
1 plastic zippy case, 150 x 90 x 50mm; or 1 commercial doorbell case from Dick Smith Electronics (see note 1)
4 1.5V AA cells (alkaline)
1 4 x AA battery holder (square for zippy case, long for DSE case)
1 75mm 8-ohm loudspeaker
1 front doorbell switch (DSE Cat. P7554; Jaycar Cat. SP-0780)
4 5mm spacers (25mm for DSE case)

Semiconductors
1 74C14 hex Schmitt trigger inverter (IC1)
1 4007 complementary pair plus inverter (IC2)
3 BC558 transistors (Q1,Q2,Q4)
1 BC548 transistor (Q3)
1 BC337 transistor (Q5)
1 BC327 transistor (Q6)
2 1N914 signal diodes (D1,D2)

Capacitors
2 100µF 16VW RB electrolytics
1 10µF 16VW RB electrolytic
2 2.2µF 25VW RB electrolytics
1 0.22µF 63VW MKT
4 0.1µF 63VW MKT
1 .033µF 63VW MKT
2 .01µF 63VW MKT

Resistors (0.5W, 1%)

1 4.7MΩ 5%	1 150kΩ
1 3.3MΩ 5%	1 120kΩ
1 2.2MΩ 5%	4 10kΩ
2 680kΩ	2 8.2kΩ
1 330kΩ	1 6.8kΩ
1 220kΩ	2 1.5kΩ

Miscellaneous
Tinned copper wire; insulated hook-up wire; figure-8 bell cable; machine screws, nuts & washers.

Note 1: the Dick Smith Electronics doorbell case is available only as part of a complete kit.

Don't spend big bucks on batteries for your Sony Walkman®. This simple voltage regulator will let you power it from a plugpack supply or from your car's cigarette lighter socket.

The Eliminator

By MARQUE CROZMAN

If you like listening to your personal player in the car or while relaxing in your favourite chair, then this project is a must. It's a very simple voltage regulator circuit that's designed to conserve the player's batteries for those times when you want to listen "on the move".

We've christened the project *The Eliminator* because that's just what it does – when it's plugged in, it effectively eliminates (or bypasses) the player's internal battery. In use, *The Eliminator* is simply connected between a plugpack supply (or car battery) and the player's DC socket. Its job is to accept the +12V (nominal) from the plugpack supply and regulate it to the DC voltage required to run the player.

Because it only uses low-cost parts, the savings in batteries will very quickly pay for this project. It's also a snack to build and get going. In fact, we reckon that even a rank beginner could build this design.

The circuit can also be easily customised to meet your requirements. Some personal players require two AA cells (3V), while others require three (4.5V) or even four (6V). For this reason, we've designed the project so that it can deliver either 3V, 4.5V, 6V or 9V. All you have to do is select one resistor value from a table.

An important safety aspect of this project, particularly for beginners, is that no mains wiring is required. Instead, it's designed to run from a car battery or from a DC plugpack supply. You can use any DC plugpack supply with a rated output voltage of 9-12V.

However, the project is not just confined to powering personal players from a DC supply. Because it was originally intended for use in a mains-powered project, the PC board also has provision for a four-diode bridge rectifier. By adding this bridge rectifier, the circuit can be powered from a 15VAC (or less) mains transformer.

In this application, however, the

A power supply for personal radios

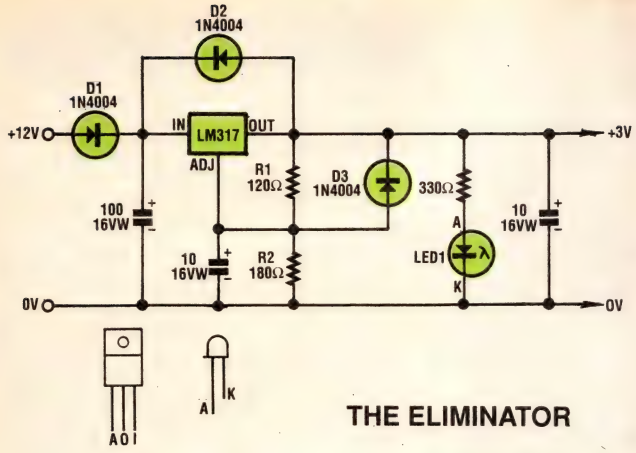


Fig.1: the circuit is based on an LM317 3-terminal adjustable regulator. The output voltage can be varied between 3V & 9V by choosing the value of R2, as shown in Table 1.

TABLE 1	
R2	**Output**
180 ohms	3V
330 ohms	4.5V
470 ohms	6V
750 ohms	9V

four diodes in the original bridge rectifier have been replaced by a single diode (D1) and a wire link. We don't need the bridge rectifier, since we are using a DC supply only.

Circuit details

Refer now to Fig.1 which shows the circuit details.

As you can see, The Eliminator is based on an LM317 3-terminal positive voltage regulator. This device is capable of delivering up to 1.5A (with adequate heatsinking), has an output voltage range from 1.2-37V, and features internal thermal overload and short circuit protection, In short, it is virtually "blow-up" proof.

Let's take a closer look at how it works. The +12V rail from the plugpack (or car battery) is applied to the input of the LM317 regulator via reverse polarity protection diode D1. In operation, this regulator is designed to provide 1.25V between its OUT and ADJ (adjust) terminals but note that the current flowing through the ADJ terminal is negligible.

This makes the device extremely easy to use, since we require just two resistors to set the output voltage. Since the voltage between the OUT and ADJ terminals is fixed at 1.25V, it follows that the current through R1 and R2 is also fixed. This gives a simple formula for the output voltage, as follows:

$V_{out} = 1.25(1 + R2/R1)$

In our circuit, R1 is fixed at 120Ω while R2 is selected from Table 1 to give the required output voltage. In our case, we used a value of 180Ω to obtain a 3V output. If you want a 4.5V, 6V or 9V output, then just select the appropriate resistor value from Table 1.

Alternatively, you could replace R2 with a 1kΩ trimpot to make the output continuously variable over the 1.25-9V range.

A 100µF electrolytic capacitor is used to filter the incoming supply voltage, while the output of the regulator is filtered by a 10µF capacitor to ensure stability. Notice also that the ADJ terminal is bypassed using a second 10µF capacitor, to improve the ripple rejection.

D2 protects the LM317 from any reverse voltages which may generated across the output by inductive or capacitive loads, while D3 discharges the 10µF capacitor on the ADJ termi-

PARTS LIST

1 PC board, code SC04104921, 48 x 61mm
1 aluminium case 100 x 58 x 45mm (Jaycar Cat. HB-5100)
1 Dynamark front panel label, 55 x 190mm
4 6BA x 10mm machine screws, nuts & lock washers
6 PC stakes
1 200mm length of medium-duty hook-up wire

Semiconductors
3 1N4004 diodes (D1-D3)
1 LM317 voltage regulator
1 5mm LED (LED 1)

Capacitors
1 100µF 25VW PC electrolytic
2 10µF 25VW PC electrolytic

Resistors (0.5W, 1%)
1 120Ω
1 R2*

*The value of R2 must be selected from Table 1 or a 1kΩ trimpot can be used instead

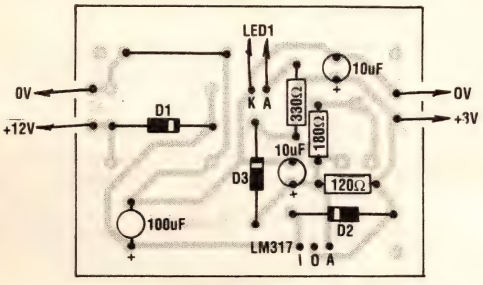


Fig.2: the circuit is shown here wired for a 3V output but this can be varied by changing the value of the 180Ω resistor (see Table 1). Mount the LM317 regulator at full lead length & with its metal tab adjacent to the edge of the PC board.

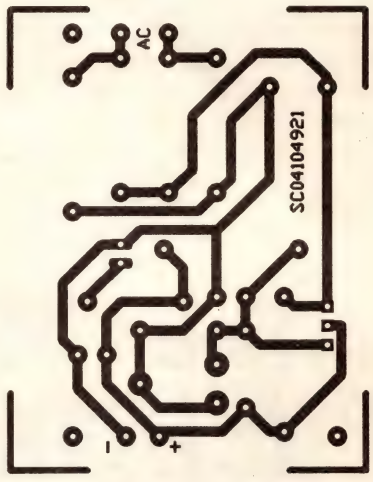
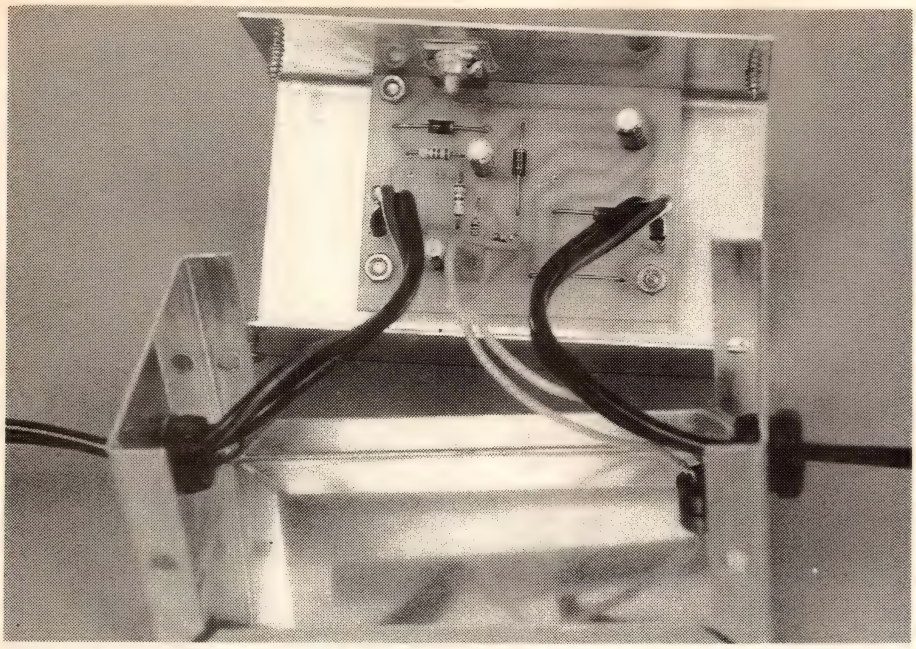


Fig.3: here is the full-size etching pattern for the PC board.



The PC board is mounted on the base of the metal case & secured using machine screws, nuts & spacers. Take care with the polarity of the external leads.

nal if the output is short circuited.

Finally, LED 1 and its associated 330Ω current limiting resistor provide power on indication.

Construction

All the parts are mounted on a small PC board coded SC04104921 – see Fig.3.

Begin the assembly by installing PC stakes at the six external wiring points, then install the wire link. You now have to select R2 from Table 1 to obtain the required output voltage. We wanted an output voltage of 3V, so we used a value of 180Ω as shown in Fig.3. If you want an output voltage of 6V, for example, just substitute a 480Ω resistor instead.

The remaining resistors can now be installed, followed by the diodes and the capacitors. Make sure that the diodes and capacitors are oriented exactly as shown in the diagram.

Finally, the LM317 regulator can be installed. Mount it with its metal tab towards the edge of the board and leave its leads at full length.

The completed board assembly is housed in a small metal case which also acts as a heatsink for the LM317 regulator. Mark out and drill the three mounting holes in the base to accept the PC board, then mount the board using 5mm spacers, machine screws and nuts.

When the board is in place, mark the mounting hole for the LM317 on the side of the case, then remove the PC board and drill the hole to 3mm. Carefully deburr this hole so that you get a perfectly smooth surface, then reinstall the PC board in the case.

Fig.5 shows the mounting details for the LM317. As shown, its metal tab must be isolated from the case using a mica washer and insulating bush. Smear both sides of the mica washer with heatsink compound before bolting the assembly together. When this has been done, use your multimeter (set to a high resistance range) to confirm that there is no connection between the tab and the case.

If the meter indicates a short, remove the assembly immediately and locate the source of the problem (eg, a piece of metal swarf may have punched through the mica washer).

Next, attach the adhesive label to the lid and drill a hole to accept the LED bezel. This done, mount the LED in position and connect it to the PC board using short lengths of hook-up wire. Take care with the LED polarity

TABLE 2	
Brand	**Plug Size**
Sanyo	1mm
Sony & Aiwa	1.3mm
Casio	1.6mm
JVC	3.1mm
Others: generally 2.1mm or 2.5mm	

Note: there is no fixed convention as to which terminal is positive & which is negative. Check the socket of your player - there is usually a small diagram next to it to indicate the wiring polarity

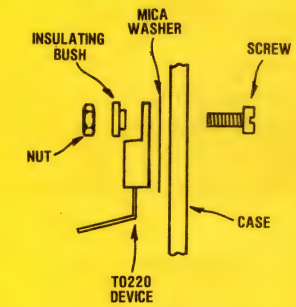
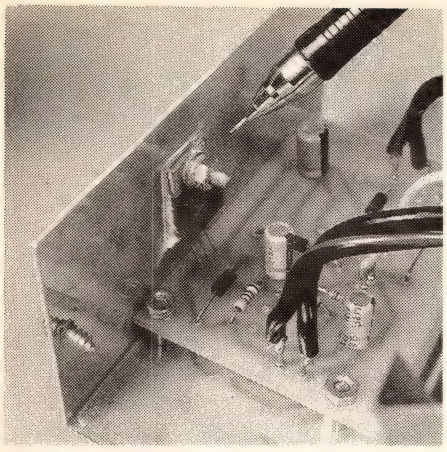


Fig.5: the LM317 3-terminal regulator must be isolated from the case using a mica washer & insulating bush. Smear all mating surfaces with heatsink compound before bolting the assembly together, then use your multimeter to confirm that the metal tab has been correctly isolated from the case.

Fig.4: this is the full-size artwork for the front panel.



The LM317 regulator uses the case as a heatsink. Make sure that it is electrically isolated from the case as shown in Fig.5.

– the cathode lead is the shorter of the two (see Fig.1).

The assembly can now be completed by installing the input and output leads. These are fed through holes in the ends of the case and secured by cordgrip grommets. You will have to fit the output lead with a DC plug to suit your particular player (see Table 2). Make sure that you get the polarity correct – the polarity indication will usually be moulded into the plastic adjacent to the socket.

For in-car use, the input lead is simply a length of figure-8 cable attached to a cigarette lighter plug. Again, make sure that you get the polarity correct. If a plugpack supply is used, the input lead will come directly from the plugpack itself. You can either connect the plugpack supply to *The Eliminator* via a DC socket mounted on the side of the case or you can solder the wires directly to the PC board.

Testing

Double check all wiring and component orientation before you assemble the case. All OK? If so, screw the two halves of the case together and connect the unit to your 12V power supply. If everything is working OK, the LED will come on. Check the output voltage and polarity with your multimeter – it should be very close to the selected value.

Alternatively, if you substituted a 1kΩ trimpot for R2, you simply adjust the pot until you get the desired output voltage. **SC**

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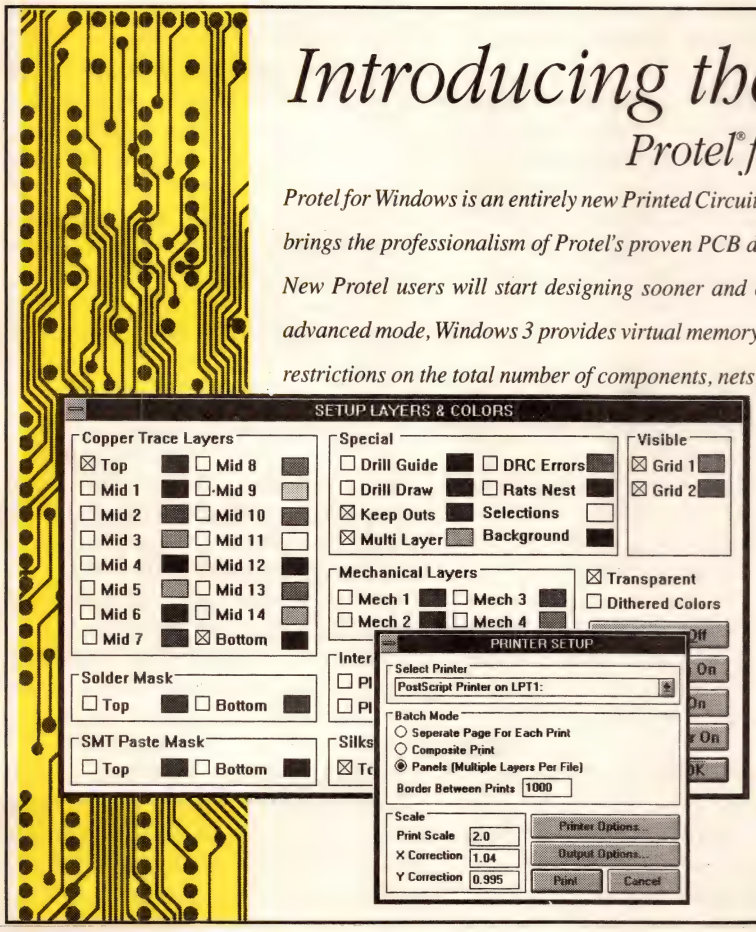

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SERVICEMAN'S LOG

Five faults all at once!

A heading like that is hard to ignore. Likewise the customer's claim as she went through the list of faults. Superficially, at least, it was a formidable list and I could only hope that it wasn't as bad as it sounded.

The device in question was a Panasonic TC-2969 TV set, an upmarket unit which first appeared about four years ago although this particular set is only about three years old. It is a 73cm model featuring, among other things, an elaborate remote control unit.

It has been a very popular set. My dealer colleagues, between them, have probably sold around 150 in this area but the number of faults I have encountered has been extremely small.

This set belongs to one of my long-standing customers, an elderly widow, but most of my dealings were with her daughter and son-in-law, who were better able to transport the set and describe the various faults.

I have had one previous call to this set but that was hardly the set's fault. About 12 months ago, it was the victim of a lightning strike to the power lines which, as well as damaging the set, knocked out a microwave oven, the electric stove and the hot water system. In fact, about the only thing that escaped in the household was the video recorder – a typical Murphy touch.

My first insight into the problem was a phone call from the owner's daughter, who proceeded to list all the faults it was exhibiting. And, as already intimated, it was a formidable list.

The first fault appeared not long after I had serviced it and took the form of occasional spontaneous shutdown; ie, the set would simply turn itself off. But while this was mildly annoying, it wasn't regarded as very serious; it needed only a touch of the remote on/off control button to turn it back on.

Fault number two caused the set to randomly change channels, again intermittently and also easily remedied via the remote control.

Fault number three could be almost rated as two faults: random changes of brightness, or the same effect on colour saturation.

Fault number four was a fairly recent manifestation. It had happened on only a couple of occasions but was somewhat more serious. As the daughter described it, it was "... a kind of blurting noise; frighteningly loud. Nearly scared Mum out of her wits".

And then she went on to describe fault number five which had occurred the previous evening. She and her husband had been visiting her mother and enjoying a TV program when the screen suddenly went black.

But it wasn't a shut-down as in fault number one because the sound was still running and there were traces of the brighter colours on the screen. This was something new and it finally convinced them to seek my help.

So there we had it – five different intermittent faults. Naturally, there wasn't any point in trying to tackle a problem like that in a lounge room; it had to come into the workshop. Fortunately, the son-in-law had a ute and plenty of help on hand to load the set into it. And so it finished up on my counter.

Related faults

Now tracking down any one of those faults could be a nasty job. But was tracking down five going to be any harder? Not necessarily. In fact, it didn't need Sherlock Holmes to deduce that all five faults were almost certainly related; find the cause of one and you'd probably find the cause of them all.

That was the bright side. The dark side was that it was still an intermittent and likely to take a lot of time to track down. I started by simply turning the set on as it came in and, sure enough, the number five fault just described was still in evidence; ie, normal sound but a dark screen with just a hint of colour. And, by using the remote control unit, I could change channels, as evident by the sound.

It is necessary to digress here, so that the reader can follow the next step. As is common with many upmarket sets, this set's remote control system offers a multitude of functions; far more than most people find necessary and more than some people can handle.

In this case, the controls include the usual on/off button, 10 channel selecting buttons, an up/down button which takes the set through the channels one-by-one, a button to allow a

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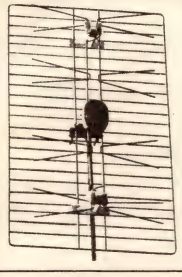

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channel number – up to about 30 – to be keyed in, volume up/down, stereo sound enable/disable, video up/down and audio up/down.

Suitably activated, the video up/down provides a choice of brightness, contrast and colour saturation control. The audio up/down operates similarly, providing bass, treble and balance control. And any settings selected by these controls are held after the set is turned off, or even unplugged from the mains.

There is also a TV/VCR switch which allows the control unit to be used on a Panasonic VCR. It provides all the usual VCR control functions: stop, rewind, fast forward, record, etc.

Then there is a another group of five buttons. Button 1 switches from TV to video input; button 2 is a timer, to shut the set down after a selected time; button 3 displays the channel number in the top right corner of the screen; button 4 provides sound mute (now what would anyone want that for?); and button 5 is marked "N" (for normalising).

Complicated? You bet it is. And many a viewer has got himself into a hopeless mess trying to cope with all those facilities. In particular, it is all too easy for the beginner to black out the screen or mute the sound, and then forget how to undo it and go into panic mode.

Hence the above mentioned "N" button, which is almost an admission of the extreme complexity. It effectively cancels all the control instructions that have been fed in and takes everything – brightness, contrast, colour saturation, sound settings, etc – back to their mid-position (or "normal") settings. From there, the user can start all over again.

TETIA TV TIP

Samsung TV chassis No. P50F & RM101 (used in Samsung, Tempest, Akai and Toshiba models)
Symptom: picture size is small and pulsates, never quite filling the screen. The 125V rail is low but shows no sign of fluctuation. Reducing the picture contrast stops the pulsation but does nothing to increase the size.
Cure: STR30125 voltage regulator IC defective. This is the main cause of the small picture – the pulsation is a secondary effect produced by the low rail voltage on the Automatic Beam Current Limiter. Resetting the contrast has the effect of reducing the beam current, so the pulsation stops.
TETIA TV Tip is supplied by the Tasmanian branch of the Electronic Technician's Institute of Australia. Contact Jim Lawler, 16 Adina St, Geilston Bay, 7015.

Back to the interruption

That brings us back to where I interrupted myself; with the set on the bench with normal sound but only a few spots of colour on a black screen.

I hit the "N" button and up came the picture with normal brightness, contrast and colour. I then tried something else. Using the remote control, I activated the brightness function and wound it down to minimum, then did the same for the contrast. And that exactly duplicated the condition of the set when it came in.

All this was quite significant. It supported a theory I had been toying with from the start: that the fault was not, as might have at first been imagined, in the remote control system itself. Rather, something was "telling" the microprocessor to do these things – in this case to turn down the brightness and contrast. That "something" could be almost anywhere in the set. All I had to do was find it.

I let the set run all day and every day for about a week. During that time, it exhibited almost all of the faults listed above; all, in fact, except fault number four (the distressing blurting noise). More importantly, I confirmed that these effects were totally random; they didn't appear to be related to temperature, period of operation, operation of other appliances on the same power circuit or, in fact, anything that I could pin down.

But that very randomness created a gut feeling that it was due to a dry joint somewhere in set. The back was already off the set and so, armed with my favourite sledgehammer, I set to work. (The sledgehammer is really just a large screwdriver, the plastic handle of which is the right weight to deliver an appropriate blow to the circuit board).

Looking into the back of the set, there is a large horizontal board, about 350 x 200mm, in the bottom of the cabinet. This carries the power supply and the horizontal and vertical output

FORTUNATELY, THE SON-IN-LAW HAD A UTE ~& PLENTY OF HELP TO LOAD THE SET INTO IT...

stages. On the lefthand side there is a similar size signal processing board which is mounted vertically. This carries the tuner, IF strip, stereo decoding, remote control processing (but not the receiver), and the audio/visual inputs and outputs.

On the righthand side there is a smaller board, about 150 x 100mm, which carries additional horizontal components and the pincushion correction components, etc.

I tackled the horizontal board first, starting on the lefthand side, tapping moderately hard and watching the screen in the mirror. No joy. I made my way across to the righthand side, again without any result until I tapped the horizontal output transformer, which is at the right rear of the board.

Suddenly, there was a reaction. I can't remember which fault it was, or whether there was more than one, except that it probably changed channels. Anyway, it was what I was after.

Well, that was encouraging. The only snag was, I couldn't repeat it. No matter how hard I bashed after that, there was no response. I left it for a while, tried again, left it, tried again, and so on for more times that I can remember. The result was, at best, "iffy"; a couple of times I achieved a brief response but nothing consistent.

Nevertheless, it did seem to suggest that the fault was not on the board, but somewhere nearby, and that the vibration I was imparting to the board was being transferred to it.

So what was closest? There is an "L" shaped aluminium plate near the horizontal output transformer, best envisaged as lying on its side, with the longer section, about 200mm long and 80mm high, running from the back towards the front of the set. The shorter section, about 40mm long, runs parallel with the back of the cabinet and provides the support.

One of this plate's functions is as a heatsink for the horizontal output transistor, which is mounted towards the rear. It also carries a heavier, finned heatsink at the front for the power supply regulator IC and a couple of large resistors. And when I tapped this, ever so gently, the set "went mad", changing channels and varying brightness, contrast and colour.

But then it, too, settled down and I went back to the main board again. But no joy here either. So over the next few hours, in between other jobs, I went through several tapping sessions. I achieved some brief responses but, more importantly, I concluded that the aluminium bracket was the more sensitive of the two, although the point to be tapped was most critical.

And it was while I was establishing this critical point that I encountered fault number four; the blurting sound. And it was only then that I fully appreciated why it had "nearly scared Mum out of her wits". With my head half inside the cabinet while I was probing, it must have hit my eardrums at about 10dB above the threshold of pain and it came close to having a more drastic effect on me than it had on "Mum".

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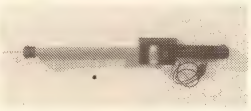

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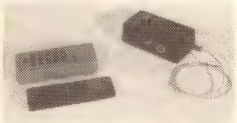

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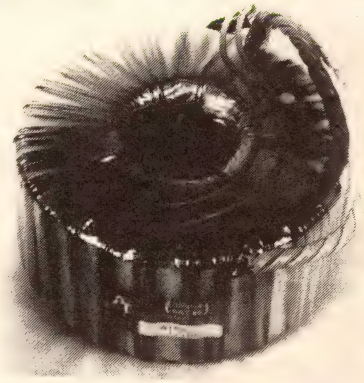

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What happened next was more fortuitous than scientific. The set was on a bench near one of the windows and, in the late afternoon, the sun shines directly into my eyes. I have a blind fitted to take care of this situation and this darkened the area considerably but it was still light enough to see what I was tapping.

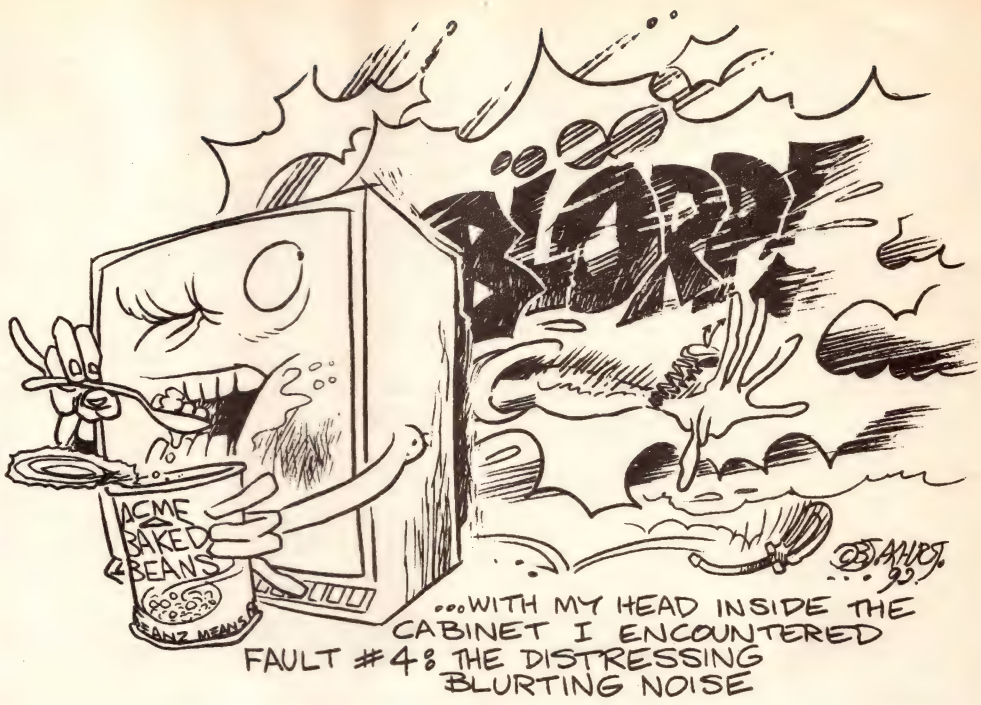
And so I had another go at the aluminium bracket. After a couple of tries, I found the sensitive spot again and the set gave forth with another raspberry. This time, fortunately, I had moved back a little, so it wasn't quite so traumatic.

But, more importantly, I happened to be looking at the right spot at the right time. The horizontal output transistor is in a TO-3 case, connected to the main board via three flying leads. The base and emitter leads are soldered directly to the appropriate pins but the collector lead is connected to the case via a solder lug secured under one of the mounting screws.

At the instant the system took off, I was looking at this solder lug. And there it was – a tiny spark, clearly visible in the subdued light. From there on it was routine. Closer examination confirmed that what was supposed to be a soldered connection between the lead and the solder lug was no such thing; it was a classic dry joint.

And that was it; a few moments work with some flux and a hot iron produced a proper joint and all the problems were solved. It was almost an anti-climax, except that I had the satisfaction of knowing that I had finally cracked it.

But there was one puzzling aspect. I would normally expect such a fault, in that position, to take out the transistor. So why had it survived? I dunno please; ask Murphy.



Confusing symptoms

My next story involves a 53cm AWA colour TV set and some very confusing symptoms. Indeed, symptoms are not always what they appear to be at first glance. And if you don't get the symptoms right, well ...

The set involved is an AWA model SC5326, which uses the "Q" chassis. The "Q" chassis is a mite long in the tooth now; it first appeared at least 10 years ago and remained current, with minor variations, for several years.

This particular set has been through the workshop several times, mainly for minor faults, but is still in good nick and has a few years of life left in it yet.

Initially, the owner contacted me by phone and, from the symptoms described, it appeared that the picture was rolling very rapidly. When I suggested that he try adjusting the vertical hold control – on the front of the set – he replied that he had done that, but that it didn't seem to make any difference.

This clearly indicated that it was not a simple case of maladjustment, so I said "bring it in". When it arrived, I switched it on for a preliminary check while the customer was still there. This confirmed the customer's observations and also seemed to confirm my interpretation of them; that the picture was rolling very rapidly upwards.

I tried the vertical hold control but it had only a very slight affect on the upward movement in one direction. Rotating the vertical hold control in the other direction then caused the picture to suddenly reverse direction and roll rapidly downwards.

Well, I hadn't seen anything like that before and any suggestion of a quick fix was out of the question. And so the customer had no option but to leave it with me.

A little later, I turned the set on again and studied the problem more leisurely. I still couldn't make sense of the hold control behaviour, so I decided to disconnect the line to the sync separator and let the vertical circuit float. Normally, this would enable me to roll the picture slowly in either direction and even hold it briefly (with a little care).

The vertical functions are provided by IC401 (LA7800) and the video and sync pulses come in on pin 14 via a number of components, including R402 (220Ω) which was fairly easy to get at. It was also a convenient access point for the CRO and this indicated that the waveform was correct. So I lifted the resistor and tried the hold control again.

The result was rather strange. Initially, the effect was much the same as before, with the picture rolling rapidly upwards. But it was now floating and, by backing off the vertical hold control, I was able to make it roll quite smoothly and under perfect control. Well, that was better than before.

But it was when I tried to roll it slowly upwards that it baulked. I could hold the blanking bar at the bottom of the screen and move it slowly upwards until it was about half way up the screen. At that point, it started to jitter, as though the bar was bouncing

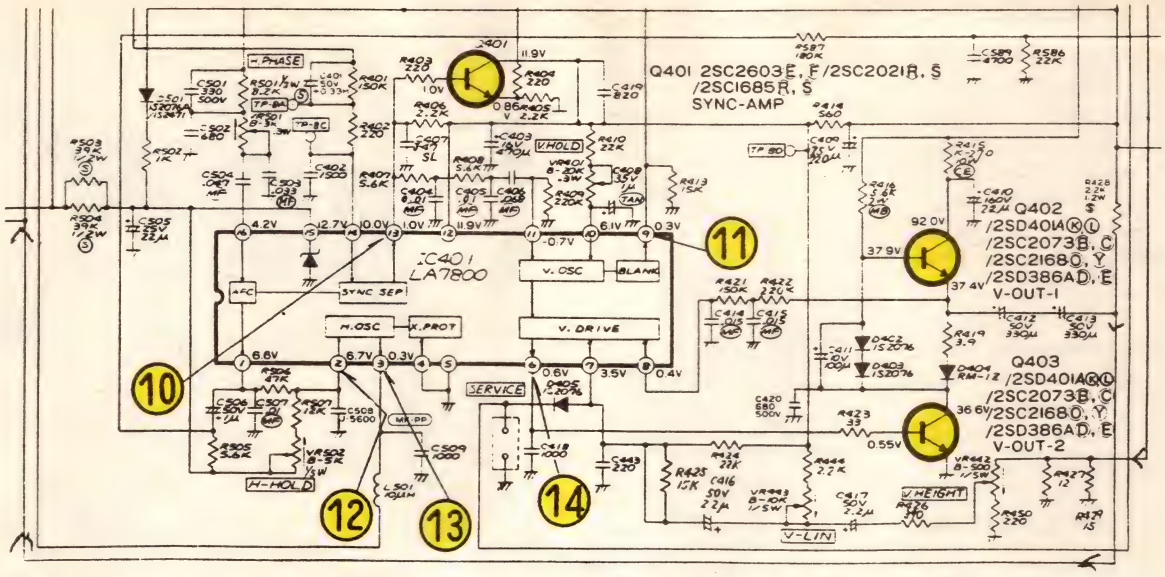


Fig.1: part of the vertical & horizontal output circuitry in the AWA SC5326. Transistors Q402 & Q403 form the vertical output stage & drive the vertical scan coils (at left) via capacitors C412 & C413.

against some obstacle. And the further up the screen I forced it, the faster it jittered.

At this point, I suddenly realised that I had been misleading myself. What I had imagined to be a fast roll was, in fact, a fast jitter. Of course, the difference was academic as far as the viewer was concerned but it was important diagnostically.

In any case, I wasn't particularly worried. There isn't a great deal to suspect in this part of the circuit and I had already mentally cleared part of it anyway. Most of the circuitry is in IC401, which contains the sync separator, vertical oscillator, blanking circuit and the vertical drive.

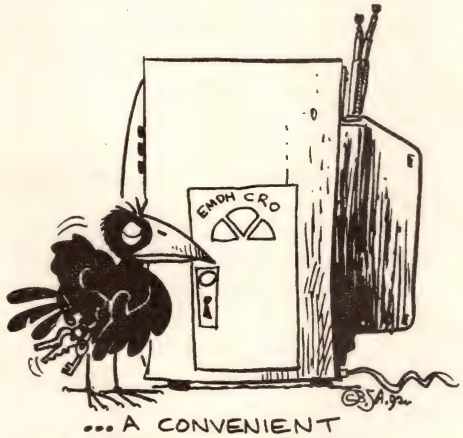
The latter comes out on pin 6 and goes to the vertical output pair, Q402 & Q403. These, in turn, drive the vertical scan coils. And it was everything from pin 6 to the scan coils that I had mentally cleared, on the simple basis that both the height and linearity, checked on a test pattern, were perfect.

So was it the chip? I did a voltage check of all the pins and found nothing abnormal. I then checked the various minor components around the chip but again drew a blank. That threw suspicion on the chip and, since I had some in stock, it was easy enough to fit a new one. But, alas, still no joy.

As far as I could see, that didn't leave anything else to check. It was time to seek help. I rang one of the service technicians at AWA, described the symptoms and told him what I had already tried. He wasn't at all fazed by my story and immediately suggested two other components: capacitor C421 (220pF) across the scan coils and C588 (1000µF) across T573 in the pincushion circuit. He explained that both these components could give trouble and create symptoms similar to those I had described.

So, full of hope, I changed both of them. But I drew another blank; it made absolutely no difference. And that really put the ball back in my court. I could hardly ask for more help; it was obvious that this was all that was known.

But the advice had done some good.



... A CONVENIENT ACCESS POINT FOR THE CRO...

It had broken through a mental barrier which had excluded anything in the output stage from my thoughts. If one component in this section could cause these symptoms, then why not another? And that brought me to capacitors C412 & C413 (330µF, 50V) in series between the output pair (Q402 & Q403) and the scan coils.

I've often puzzled over this arrangement. Some models used only one capacitor, others the two-in-series arrangement (not back to back). Anyway, in desperation I pulled them both out and fitted two new ones. And bingo! That was it; everything was now back to normal.

But the reason remains a mystery. I checked both capacitors on the capacitance meter and they both read full value. Nor did there appear to be any leakage, at least at the test voltage. Nevertheless, I suspect that leakage may be the answer – after all, what else can go wrong with an electrolytic? Or was one capacitor partially open circuit?

And what was the reason for the two capacitors in series? Had leakage proved a problem in early versions, with only one capacitor, and had someone decided that two would reduce the risk? The reasoning, of course, would be that one could fail without creating a problem, while the chances of both failing would be quite small. **SC**

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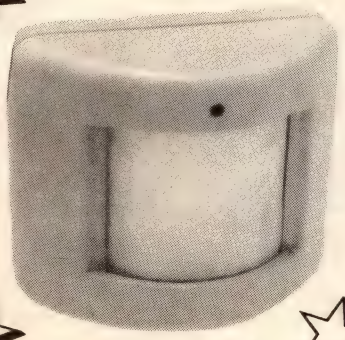
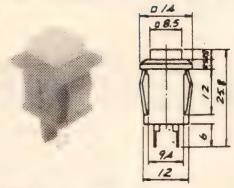


PUSHBUTTON SWITCH BARGAIN

Our suppliers sent us the incorrect switch recently, so we need to clear them out and it's your gain. Stock up now. It's a push on momentary, black body, red actuator, 125V 1A rating.
Cat SP-0705

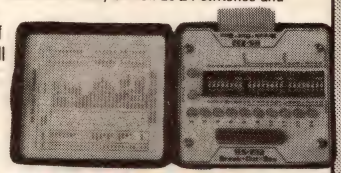
Normal price about $1.75
Bargain price .50¢ ea
10+ .45¢ / 100+ .30¢



RS232 Break out box

A simple way of checking and monitoring 25 pin D series (RS232) inputs, outputs and connecting cables. Connects in line between computer and peripheral and has 12 signal powered LEDs to indicate which lines are in use, as well as 24 switches and jumper leads to allow you to break out circuits or reconfigure and patch out of all 24 active lines. Other suppliers sell these for up to $99.95. You won't pay anything like that from Jaycar. Cat XC-5085

Only $69.95



NEW COMPONENTS

27C512 Eprom	$14.95	Cat ZZ-8474
27512 Eprom	$14.95	Cat ZZ8473
74HC374 IC	$2.20	Cat ZC-4875
6800 CPU	$1.00	Cat ZZ-8045
420 Volt Varister	.95¢	Cat RN-3406
27 ohm Thermistor	.50¢	Cat RN-3445
Fuse 800mA M205	.30¢	Cat SF-2157

THE
1992 Jaycar Catalogue
was released in March.
If you haven't got your copy yet, call into any Jaycar store or send $2 to PO Box 185 Concord 2137, and we'll send you one.

JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS

JAYCAR ELECTRONICS

Forte Speaker Kits

Jaycar proudly announce a range of good quality,very reasonably priced speaker kits. All the drivers are supplied with silver aluminium frames, silver dust covers, foam cone surrounds and black cardboard cones. The units pictured have white cones, but our stock will have black cones. These kits are ideal if you have an old set of speakers at home that don't work, or need upgrading. Simply remove the old speakers and replace with these low cost kits. Or build your own cabinets and save a fortune over commercial speakers. All kits use the same midrange, tweeter and crossover, only the woofers change. Sealed boxes are recommended.

8" 3 WAY KIT

1 x 8" Woofer
1 x 5" Midrange
1 x 3" Tweeter
1 x 3 way Xover
Cat CS-2410

$65.00 (2 required for stereo)

10" 3 WAY KIT

1 x 10" Woofer
1 x 5" Midrange
1 x 3" Tweeter
1 x 3 way Xover
Cat CS-2412

$79.95 (2 required for stereo)

12" 3 WAY KIT

1 x 12" Woofer
1 x 5" Midrange
1 x 3" Tweeter
1 x 3 way Xover
Cat CS-2414

$89.95 (2 required for stereo)

Recommended Speaker Box Sizes

Sealed boxes are recommended.

8" KIT - 30 LITRES

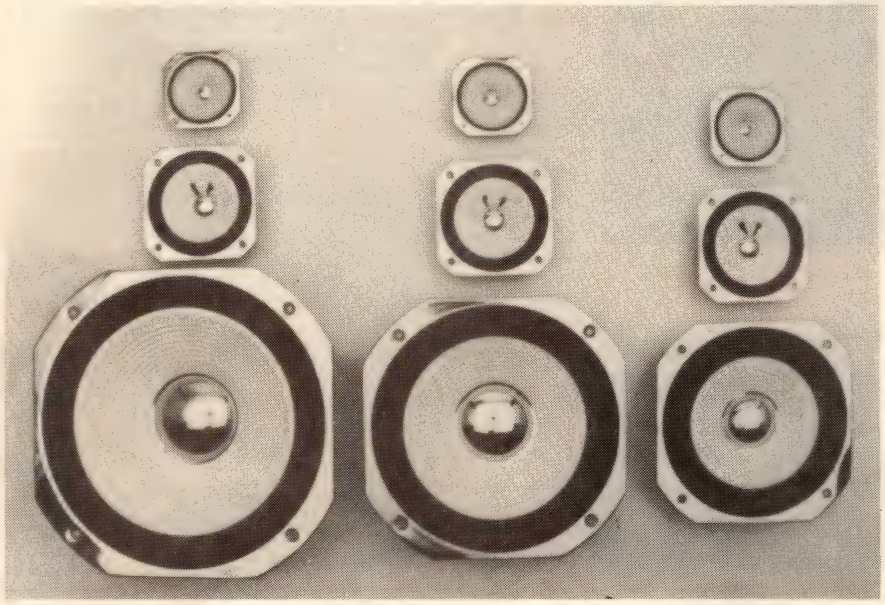
-3dB frequency 64Hz
Cabinet size:
Internal 503 x 310 x 192 (H x W x D)mm
12mm Wood 620 x 392 x 252
18mm Wood 632 x 404 x 264

10" KIT - 45 LITRES

-3dB frequency 45Hz
Cabinet size:
Internal 596 x 368 x 228 (H x W x D)mm
12mm Wood 620 x 392 x 252
18mm Wood 632 x 404 x 264

12" KIT - 120 LITRES

-3dB frequency 40Hz
Cabinet size:
Internal 799 x 493 x 305 (H x W x D)mm
12mm Wood 823 x 517 x 329
18mm Wood 835 x 529 x 341



Woofer Specifications

8" WOOFER

Power handling	40W rms
Resonant frequency	51Hz
Frequency response	51-3500Hz
Sensitivity	88dB 1W/1mt
Qms	2.77
Qes	1.24
Qts	0.85
Vas	37L

10" WOOFER

Power handling	60W rms
Resonant frequency	32Hz
Frequency response	32-3800Hz
Sensitivity	87dB 1W/1mt
Qms	2.65
Qes	1.16
Qts	0.80
Vas	108L

12" WOOFER

Power handling	80W rms
Resonant frequency	30Hz
Frequency response	30-3800Hz
Sensitivity	88dB 1W/1mt
Qms	3.37
Qes	1.39
Qts	0.98
Vas	270L

INDIVIDUAL SPEAKERS

All speakers are available individually as well as in kits

12" Woofer	Cat CW-2128	**$49.95**
10" Woofer	Cat CW-2120	**$39.95**
8" Woofer	Cat CW-2110	**$27.95**
Midrange	Cat CM-2086	**$14.95**
Tweeter	Cat CT-2001	**$8.95**

Sizes

12"	A 325mm, B 333mm, C 290mm
10"	A 277mm, B 283mm, C 240mm
8"	A 228mm, B 228mm, C 188mm
Mid	A 127mm, B 135mm, C 110mm
Tw	A 89mm, B 92mm, C 75mm

AVAILABLE THIS MONTH

ECONOMY 1141 PIEZO

Another similar design to a US-made piezo at a much lower price. We could not fault it when we tested it. Almost half the cost of the US model. Does not require a crossover. Handles 30V rms which relates to 112 watts rms into 8 ohms and 224 watts rms into 4 ohms. Ideal for PA's, band work, etc. Frequency response 2.5kHz-35kHz, Sensitivity 92dB.
Dimensions 187 x 79mm.
Cat CT-1098

$19.95

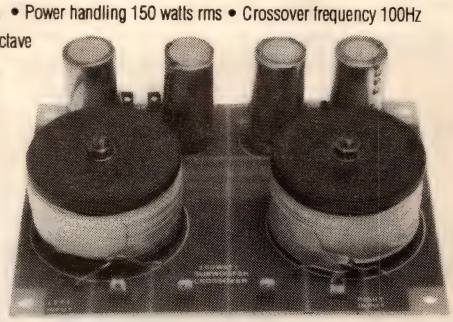
NEW

Subwoofer Crossover

Add a subwoofer to your stereo! If you don't have enough bass and want to add a subwoofer you will need a crossover. This one is designed for adding a subwoofer to an existing speaker system. The cable to the original box should be routed through this crossover then on to the speaker box. • Power handling 150 watts rms • Crossover frequency 100Hz
• Attenuation 12dB/octave
• Impedance 8 ohms.
Cat CX-2630

$55 EACH

NEW



JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS

JAYCAR ELECTRONICS

Economy Wireless Security System *SELLOUT*

Install your own wireless burglar alarm and don't pay an arm and a leg! The EG100 is made by Zeus, the same people who make our current wireless system, in fact, all the same wireless extras will work with this panel. The EG100 is a key operated signal sector panel which accepts not only the wireless PIRs etc, but you can hard wire detectors as well. Eg 2 wireless PIRs, 2 wireless door/window transmitters and a wired PIR will all work very happily on the one sector. This is the lowest prices wireless panel we've seen that is TOP QUALITY. There are plenty of junky ones around that we just won't sell. After all, a burglar alarm that false triggers is no good to anyone.

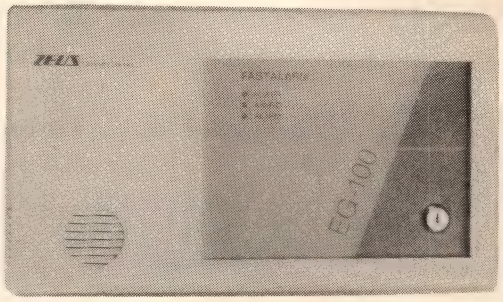
FEATURES: • Low cost • DIY installation • Accepts wireless and wires sensors • Tamper proof protected ∫ LED indicators • Keyswitch arming with exit delay time • Instant alarm when sensors triggered • NC and NO relay output.

SPECIFICATIONS: • Operates on 303-875MHz • System codes 4,096 • Transmitting range 50 metres (open space) • 30 second exit delay • Instant entry delay.

ACCESSORIES: • Backup battery 1.2A 12V cat SB-2480 $26.50 • Wireless passive infra red detector Cat LA-5205 $129.95 • Door/window reed switch Cat LA-5210 $69 • Siren 12V DC Cat LA-5700 $28.50 • Strobe light Cat LA-5300 $32.95 • Wired PIRs from $49.95.

Cat LA-5202

Includes 240V power supply **WAS $249 MAY PRICE $199 SAVE $50**



NEW PENRITH STORE

199 HIGH STREET

TELEPHONE NUMBER

(047) 21 8337

FACSIMILE NUMBER

(047) 21 8935

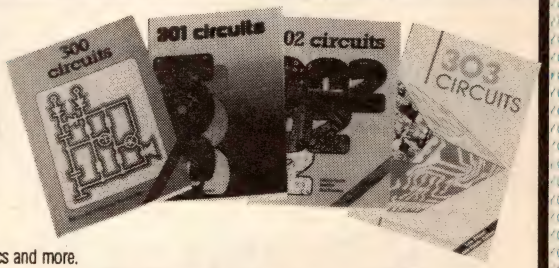
OPEN 7 DAYS A WEEK

Saturday 9am - 4pm

Sunday 10am - 4pm

NEW BOOKS NEW BOOKS NEW BOOKS NEW BOOKS

CIRCUIT BOOKS



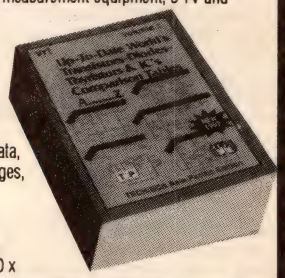
Four fabulous new books published by Micro Tech for Elektor Electronics. Each book has 300 circuits aimed at the electronic enthusiast, professional or amateur. They offer a comprehension collection of practical ideas, concepts and developments, many of which have been in annual Elektor magazines. You will find circuits for audio and video, car, cycle and motorcycle, home and garden, receivers and aerials, hobbies and games, measuring and testing, oscillators and generators, current sources and power supplies, microcomputer and music electronics and more.

300 Circuits Cat BM-2470 **$19.95**
301 Circuits Cat BM-2471 **$19.95**
302 Circuits Cat BM-2472 **$19.95**
303 Circuits Cat BM-2473 **$19.95**

To give you an example of these circuits - the 303 circuit book includes 32 audio and Hi Fi projects, 14 circuits for cars and bicycles, 43 computer and microprocessor circuits, 11 electronics projects, 24 HF and VHF circuits, 16 circuits for a number of hobbies and pastimes, 54 projects for home and garden, 29 power supply circuits, 29 circuits for test and measurement equipment, 9 TV and video project, as well as 42 design Ideas

BRAND NEW 1992 EDITIONS

UP TO DATE WORLD'S TRANSISTORS, DIODES, THYRISTORS & ICS, COMPARISON TABLES. TWO VOLUMES.



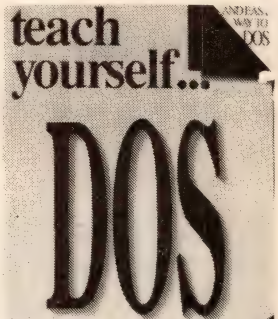
Vol 1 - A-Z

Comparison tables of transistors, diodes, thyristors and IC's. Nearly 28,00 types with brief data, pin assignment. Over 80,000 comparison and equivalents. Excellent reference book, 967 pages, 110 x 150 x 43 (thick)mm. Cat BM-4580 **$19.95**

Vol 2 - IN-60,000-μ

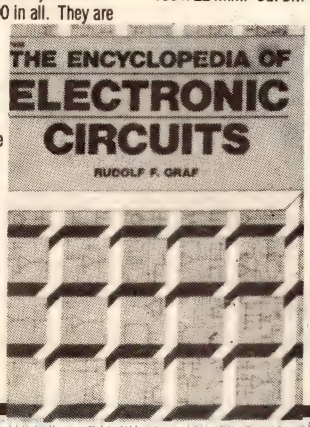
Comparison tables and brief data and pin assignments of another 28,000 types of transistors, diode and ICs of daily use. Over 80,000 comparisons and equivalents given. 950 pages, 110 x 150 x 42 (thick) mm. Cat BM-4582 **$19.95**

Teach Yourself DOS 3.3 & 4.0



By Al Stevens. This remarkable how-to quickly cuts past computer mumbo jumbo of conventional documentation to reveal DOS's capabilities and power. Veteran author Al Stevens uses non-technical language to deliver indepth information on MS and PC DOS commands and operations. Teach yourself to set up fixed and floppy disk systems with easy-to-understand instructions contained in this book. Arm yourself with real time saving techniques including file maintenance and file protection. Improve your computer's efficiency and effectiveness. Learn how to back up and archive files for safe storage. Master easy ways to handle tricky file directories. Improve your disk formatting and copying techniques. Experiences users will find comprehensive information on more advanced topics such as batch files and Edlin (the DOS editor). Maximised learning - overview of DOS for the new DOS user - DOS commands - Paths, filters, pipes and input/output redirection batch files - EDLIN- Useful commercial utility programs - Index to general user needs - Glossary of commonly used terms. 267 pages, 153 x 224mm. Cat BM-2475 **$19.95**

The Encyclopedia of Electronic Circuits

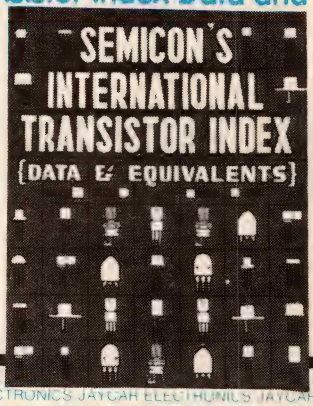


By Rudolf F Grat. This book has a circuit schematic for just about everything you could think of to build, nearly 1,300 in all. They are listed alphabetically and divided into 98 basic circuit categories. For example the sections starting with the letter A are: Alarms, Amateur radio, Amplifiers, A to D converters, Attenuators, Audio mixers, Audio oscillators, Audio power amps, Audio signal amps, Automotive. This is the hobbyists and technicians dream treasury of both analog and digital circuits. From amateur radio and crossover networks to fibreoptics, test circuits, motor control, video circuits, times, etc, with special emphasis on state-of-the-art IC circuit technology. Also included is a huge index to specific circuits. A massive 760 pages, size 175 x 230mm.

WAS SELLING FOR $69.95

Cat BM-2476 **$34.95**

Semicon's International Transistor Index Data and Equivalents



A huge data book listing data for thousands of transistors, as well as a large equivalent section. The book is designed for the engineer and technician.

Section 2 lists manufacturers names and addresses.
Section 3 is the huge alphanumeric listing of transistors with specifications..
Section 4 lists FETs with specs.
Section 5 covers injunction transistors.
Section 6 is the substitution guide.
Section 7 covers devices with prefix CV.
Section 8 lists 100's of transistor outline drawings and terminations.

591 pages, size 242 x 170mm.
Cat BM-2477 **$19.95**

JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS

JAYCAR ELECTRONICS

KITS KITS KITS KITS KITS KITS KITS KITS KITS KITS KITS

60 Watt 12 - 240V Inverter Kit

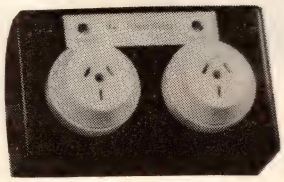
Ref: Silicon Chip February 1992
This inverter is ideal for use anywhere where 240V AC power is not available. The Jaycar kit includes an improved and larger version of the transformer specified for the 40W version, which gives an extra 20 watts to around 60 watts. Ideal for fax machines, electric toothbrushes, battery chargers for mobile telephones, incandescent lamps, etc., etc. The Jaycar kit includes PCB, box, punched and screened front panel and all specified components including the larger transformer.

Cat. KC-5108 **$99**

240V Power Relay Kit

Ref: EA January 1992
This kit will monitor the power drawn from a "master" power point socket, and automatically switch on a slave socket. It's very versatile because it can monitor one or several appliances plugged into the "master" and switch one or several devices plugged into the "slave". An ideal use for this project would be to switch on your Hi Fi system. With a four outlet board plugged into the slave socket, turning on your amplifier (in master) will switch on your tuner, tape deck, CD player and turntable etc. The kit includes PC board, box, 240 volt sockets, lead and plug and all specified components.

Cat. KA-1740 **$49.50**



THERMOSTATIC SWITCH FOR CAR RADIATOR FANS

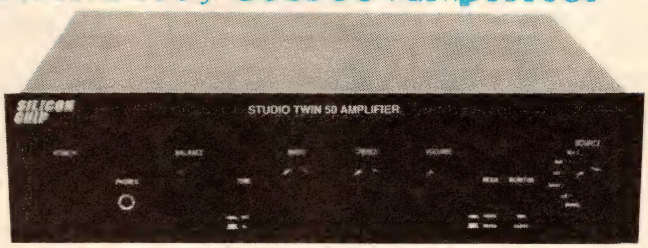
Ref Silicon Chip March 92 Has the thermostat failed on your electric radiator fan? Our electronic thermostat can replace it and be adjusted to switch on at a temperature to suit your particular vehicle. The switch will ensure that your fan cuts in and out only as required so that your engine operates at the correct temperature for peak efficiency. The Jaycar kit is supplied with diecast aluminum box, PCB and all specified components except for the sender unit (which is available from K-Mart). Cat KC-5115 **$37.95**

Dolby Surround Sound Decoder Kit

Ref: EA January 1992. Experience cinema sound in your own lounge room. The Dolby "Surround Sound" process increases the sensation of "being there" by producing an effects channel to create surround sounds which a conventionals stereo system can't produce. Hook this simple kit in conjunction with your Hi Fi VCR or stereo TV and take full advantage of movies recorded with Dolby encoding. Short form kit - includes PCB, and all on board components. Cat. KA-1741 **$39.95**

Studio Twin Fifty Stereo Amplifier

Ref Silicon Chip Feb,
March, April 1992
FEATURES OF THE TWIN 50
• 50 watts per channel with both channels driven into 9 ohm loads • Very low noise on phone and line level inputs - comparable with many DC players • Up to seven stereo program sources can be connected • Tape monitor loop • Separate ultra-low distortion stereo headphone amplifier • Stereo/mono switch • tone defeat switch • Straight forward construction.

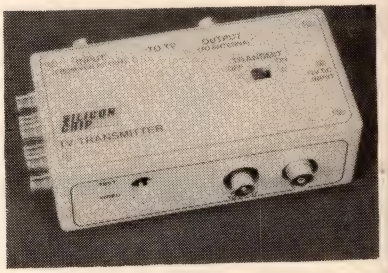


BEGINNER CONSTRUCTORS CAN BUILD THIS AMP - If you can use simple hand tools and a soldering iron you can build this project. virtually everything is board mounted making construction incredibly simple, allowing you to complete this project in a couple of nights.
PERFORMANCE SPECIFICATION • Power output (one channel) - 4 ohms 80 watts, 8 ohms 55 watts • Power output (both channels) - 4 ohms 70 watts, 8 ohms 47 watts • harmonic distortion less than 0.05% 20Hz to 20kHz at rated output level for any input or output.
See catalogue for full specifications.
The new Studio Twin Fifty is housed in a midi-sized case and comes as a complete kit including punched and screened front panel; black anodised knobs, all specified components and high quality pre-tinned printed circuit boards.

Cat KC-5110 **$299**

TV Transmitter for VHF VCRs

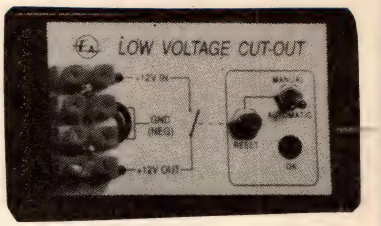
Ref Silicon Chip March 1992
How many times have you wanted to watch something from your VCR on another TV set located in another room of your house? Up until now you had to run along cables through the walls or through the ceiling. Want to fix that? Our new transmitter does away with all those cable and simply connects into your VCR, and transmits a signal to your second TV set. THe Jaycar kit is supplied with Jiffy box, front panel labels and the VHF modulator, plus all specified components except the antenna assembly and connecting VCR cables.



Cat KC-5114
$99.50

Low Voltage Cutout Kit for Cars and Boats

Ref: EA January 1992
Build this simple kit and avoid getting caught out with a flat battery. It simply connects into a 12 volt accessories power line and shuts off the flow if the batteries voltage drops to a dangerously low level, where it won't start the vehicle. The shut off voltage is adjustable over a nominal range of 10.9V to 11.9V and the unit will restore power to the load automatically when the battery voltage has returned to around 12.6V. An extremely useful and practical kit. The kit includes PC board, box, relay and all specified components.



Cat. KA-1739 **$22.95**

Karaoke Box Kit (Vocal Canceller)

Ref: EA November 1991. Karaoke is a lot of fun. With this kit you can remove the lead vocal from almost any recording, and replace it with your own via a standard microphone. It's a great way to liven up a party. Complete kit includes PC board, box, front panel and all components.
REQUIRES 2 X 9V 216 TYPE BATTERIES
CAT SB-2370
$2.85 each.

MIC TO SUIT
CAT AM-4090
$19.95

Cat. KA-1738 **$27.95**

Jaycar ELECTRONICS

HEAD OFFICE
6 Leeds Street Rhodes 2138
Telephone (02) 743 5222
FAX (02) 743 2066

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$10 - $24.99	$ 3.75
$25 - $49.99	$ 4.50
$50 - $99.99	$ 6.50
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COBURG VIC	266 Sydney Rd (03) 384 1811 Mon-Fri 9 - 5.30 Fri 8.30 - Sat 9 - 4
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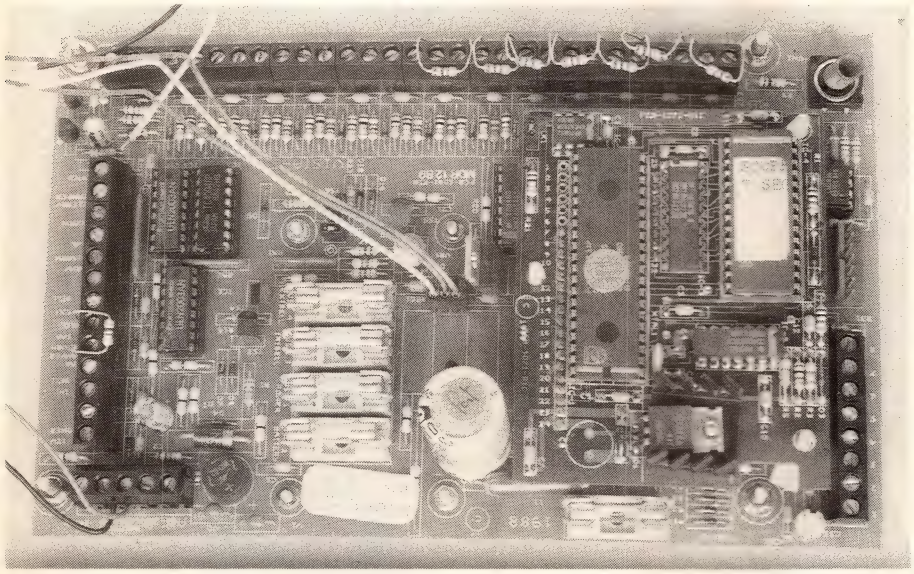
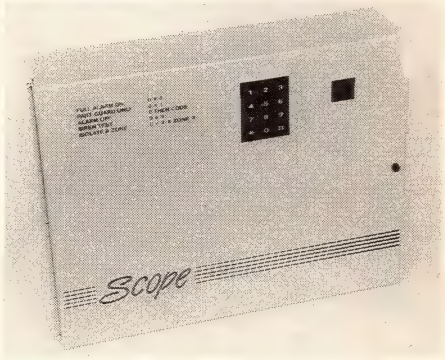
PARRAMATTA	355 Church St (Cnr. Victoria Rd) (02) 683 3377 Mon-Fri 9 - 5.30 Thurs 8.30pm - Sat 9 - 4pm Sunday 10am - 4pm
PENRITH	199 High St (047) 21 8337 Mon-Fri 9-5.30 Thurs 8.30 - Sat 9-4pm Sun 10-4pm
RHODES	6 Leeds St (02) 743 5222 Mon-Fri 9 - 5.30

JAYCAR ELECTRONICS

PRODUCT SHOWCASE





Scope programmable alarm has six sectors

This is a professionally designed and built alarm panel with six sectors and highly flexible programming, via the 12 button keyboard. As many as 51 separate facilities can be programmed but if you just want of use it as a standard 6-sector alarm, no programming is required.

Two manuals are supplied with the unit: a basic instruction manual and a 114 page installation & service manual which has all the details of programming.

Inside the case there is plenty or room for wiring and a standby battery.

The complete system, less mains plugpack and standby battery, retails for $199.50. Or you can purchase just the printed circuit board, if you want to mount it remotely. In that case the PC board costs $129.50 plus $49.95 for the intelligent remote keypad and 7-segment display.

For further information, contact your closest Jaycar Electronics store or phone them on (02) 743 5222.

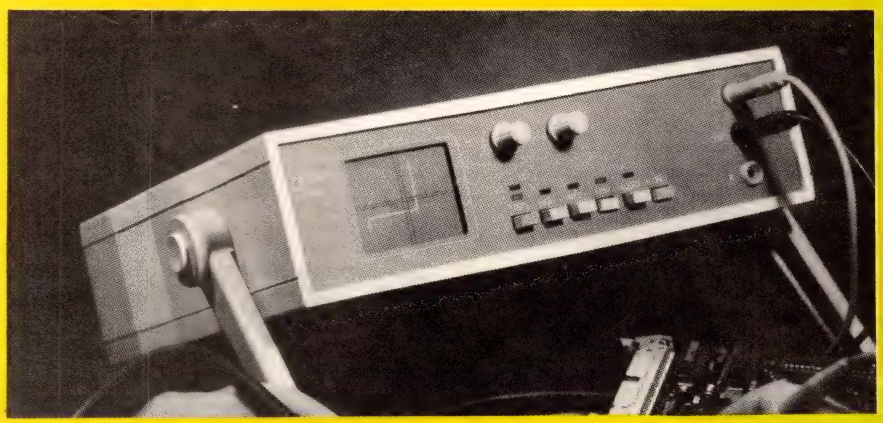
Handy magnifier for PC board inspection

Do you have trouble inspecting your solder joints on printed circuit boards. This handy magnifier makes the job much easier, whether or not you normally wear glasses. The magnifying lens is 115mm in diameter and its

In-circuit fault finder

The new T1500 from Polar Instruments is specifically designed for troubleshooting unpowered PC boards. It will test any kind of component, including linear or digital ICs, transformers, relays, discrete transistors and capacitors.

To test a suspect component, a pair of probes is placed across it. This applies a small AC voltage across the component and the Lissajous pattern resulting from plotting voltage and current is displayed on the screen. This can be compared with the normal pattern for the component (Polar calls it the "dynamic signature" of the component) which can then be accepted or rejected.



The T1500 has four ranges and two test frequencies to cope with a wide variety of components. By using the dual channel comparison technique, users can identify if the component is good or faulty. This allows operators with limited technical ability or poor documentation to locate faults to component level.

For more information, contact Mark Breznik, Emona Instruments, 86 Parramatta Road, Camperdown, NSW 2050. Phone (02) 550 1378.

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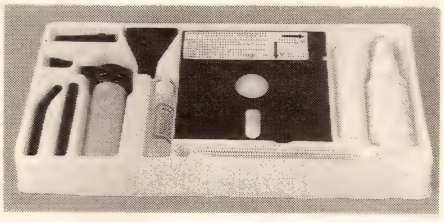
fold-up stand makes it quite convenient to work with. Use it in conjunction with a desk lamp for even more ease of use.

It is priced at just 13.95 from David Reid Electronics, 127 York Street, Sydney 2000. Phone (02) 267 1385.

Clean-up kit for computers

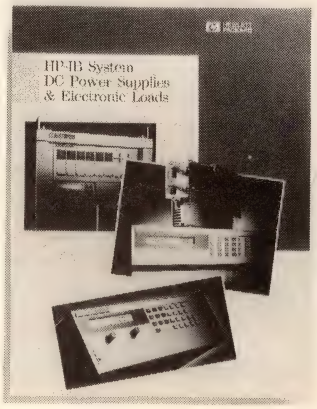


Surprising as it may seem, your computer constantly acts as a vacuum cleaner, drawing in dust particles via the cooling fan. This dirt then settles on the drives, discs and boards. This cleaning kit from Rod Irving Electronics addresses the dirt problem.

The kit has everything to clean your machine inside and out. Double-ended cleaning wands reach into crevices and antistatic cleaning pads remove dust and help in keeping it away. The battery operated mini vacuum cleaner removes dirt from keyboards, monitors, printers and PC boards. Several attachments are included.

5.25-inch and 3.5-inch cleaning discs (wet type) are provided for removing dirt from read/write heads in drives. For more information, contact Rod Irving Electronics at their Stanmore or Melbourne stores.

New catalog of HP power supplies



Hewlett Packard has just released a new catalog of their DC power supplies and electronic loads. An introductory section outlines important aspects in selecting a supply for specific applications and a quick reference to the line of DC supplies is also included.

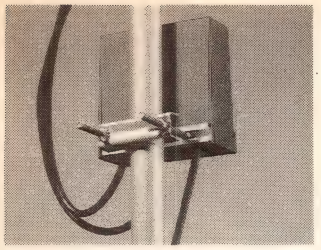
Among the programmable supplies in HP's range are single and multiple output units and a mainframe with interchangeable modules. Programmable electronic loads are offered as single input models or as modules for use in the mainframe.

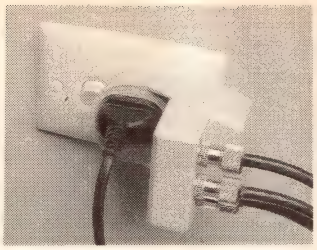
For more information, contact the Customer Information Centre, Test & Measurement, Hewlett Packard Australia Ltd, 31-41 Joseph Street, Blackburn, Vic 3130. Phone (008) 033 821.

R.C.S. RADIO PTY. LTD.

RCS Radio Pty Ltd is the only company which manufactures and sells every PCB & front panel published in SILICON CHIP, ETI and EA.

651 Forest Road, Bexley, NSW 2207. Phone (02) 587 3491.





MH series amplifier (left) & PSU1 piggy back supply unit.

New masthead amplifiers & splitters from Hill Industries

There are five models in this new range of MH series masthead amplifiers from Hills. The units are designed to cover a wide variety of applications in both the UHF and VHF frequency bands. All amplifiers have a filter which rejects FM (band 11) signals. If the unit is required to amplify FM signals as well, the filter is rendered inoperative by cutting a link.

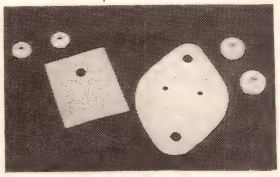
Each MH series masthead amplifier consists of two units. The amplifier itself is installed on the antenna mast and is housed in a black weatherproof box. A U-clamp and wing nuts secure it in place while the power supply comes in the form of a plugpack which can be 'piggy backed' with the TV's power plug (see photo). Thus, both the TV and the masthead amplifier are powered from the same socket. The power supply unit sends the amplified signal to the TV via coaxial cable. It also has provision to supply signal to a second TV.

The Extraset 1-4 amplified splitter.

If you need more TV or FM outlets, the Hills range of Extraset amplified splitters could be answer. There are two models. Extraset 1-4 is a self contained mains-powered unit for use in locations with ready access to 240VAC. The other, Extraset 4LP, is a line-powered 2-part unit consisting of the amplifier and a 'piggy back' power supply for use where access to 240VAC is more difficult. Both units have a single antenna input and four outputs for TV or FM radio use.

Both the masthead amplifiers and the amplified splitters can be easily installed. For more information, contact Hills Industries, 944-956 South Road, Edwardstown, SA 5039. Phone (08) 297 3888.

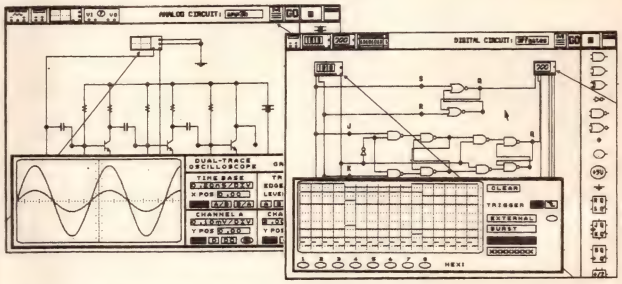
New transistor mounting washers



This new range of transistor mounting washers allows you to dispense with that messy process of applying heatsink compound. Why didn't somebody think of it before? They have a high voltage rating and come in the common sizes – TO-220, TO-3, TO-3P and so on. They are available at all Jaycar stores. ▷

Electronics Workbench®

The electronics lab in a computer!



A simple, intuitive and very powerful teaching tool, Electronics Workbench lets students and hobbyists design and test both analog and digital electronic circuits, without the delays and expense of a laboratory.

FEATURES

- Quick and simple circuit entry
- Digital and Analog Modules included, complete with all components
- Simulated instruments: dual trace scope, spectrum analyser, function generator, multimeter, digital word generator and logic analyser
- Complete control over all component values and parameters
- Print: circuit schematics, parts list, instrument readings, macros
- Logic conversion – truth table to Boolean formula to logic gates
- Customisable hypertext help system

THREE VERSIONS

- **Professional Version:** EGA/VGA colour display; unlimited components
- **Personal Plus Version:** Monochrome display; unlimited components
- **Personal Version:** Monochrome display; limited to 20 components per circuit

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NSW	(02) 519 3933
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Perth	(09) 244 2777
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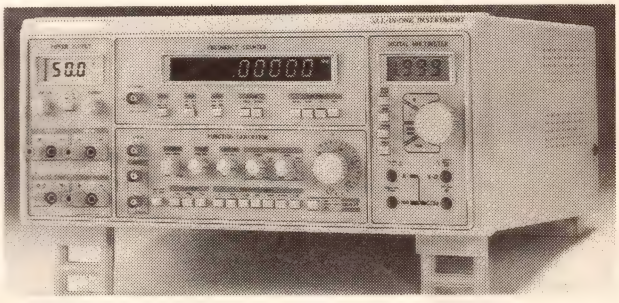
Emona LAB4

Four instruments in one package!



The LAB4 has four full function test instruments:

- **DC POWER SUPPLY**
  Triple output; 5V, 15V, 0-50V
- **DIGITAL MULTIMETER**
  Full function, auto-ranging
- **FUNCTION GENERATOR**
  0.02Hz-2MHz, with SWEEP
- **FREQUENCY COUNTER**
  1Hz-100MHz input range

INDEPENDENT INSTRUMENTS

Each instrument in the LAB4 is completely independent and can be switched ON or OFF as required. The LAB4 has only one 240V mains input, saving on multiple power points.

Each instrument is clearly defined with neatly laid out and labelled front panel controls. Also, the LAB4 is compact and only takes up a small space, compared to four bench-top instruments.

LAB4
Test Instrument Package
$722 (excl. tax)

EMONA
INSTRUMENTS

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QLD	(07) 397 7427

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Perth	(09) 244 2777
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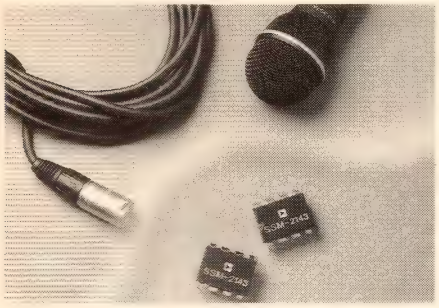
Hobart	(002) 34 2233

Balanced line receiver for audio applications



The SSM-2143 from Analog Devices is a balanced line receiver system for audio and industrial applications requiring high immunity from electromagnetic interference (EMI). It has a differential gain of 0.5 and has a common-mode rejection at 60Hz of -90dB and -85dB at 20kHz.

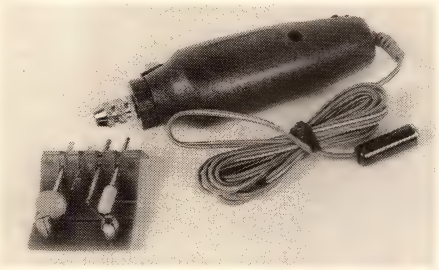
Housed in either an 8-pin mini-DIP or SOIC package, the device complements the SSM-2142 balanced line driver. Together, they provide a high performance solution to driving and receiving audio signals over long cable runs in noisy environments.

Two gain options (2 or 0.5) make it flexible for use in consumer, professional and automotive audio equipment, as well as industrial applications. For more information, contact Ian Laidlaw at NSD Australia, 205 Middleborough Road, Box Hill, Vic 3128. Phone (03) 890 0970.

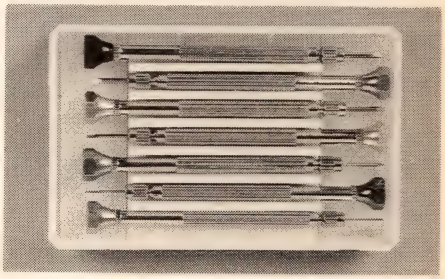
Engrave your valuables with the Easy Etch

With the ever-present risk of theft, it's a good idea to engrave your household valuables with your driver's licence number. This is only one of the possible uses of the Easy Etch Engraver. It has a steel bit and is suitable for engraving metal, plastic and wood. Replacement bits are available.

The unit is powered by a 12V plugpack and retails for $34.95. For more details, contact David Reid Electronics, 127 York St, Sydney 2000. Phone (02) 267 1385.



Micro drivers for teensy weensy screws



Most enthusiasts probably have a set of jewellers screwdrivers which let them do work on most miniature equipment but this set of drivers is for really tiny screws that the standard types are too big for. There are seven drivers in all with tip sizes of 0.6, 0.7, 0.8, 1.0, 1.2, 1.4 and 1.6mm.

They would be particularly handy if you are working on tiny brass model locomotives or their equally tiny motors and gearboxes. The set of drivers is available from Rod Irving Electronics at their Sydney or Melbourne stores.

PRESTON ELECTRONICS

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Quantum 50-Meg SCSI Hard Drive (1 only)	**$295.00**
Fujitsu 240V Coil Relays, DPDT 30A	**$9.95 ea**
Fujitsu 5V Relays, SPDT Subminiature	**$19.95**
2764 Surplus Computer EPROMs, Erasable	**$3.95**
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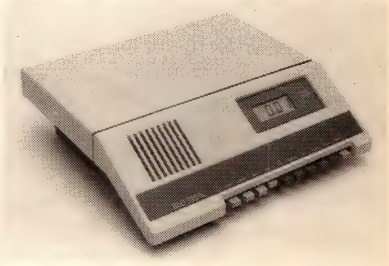
QC-1910 Super Tiger 5MHz Oscilloscope	**$29.95**
TEEPROM EPROM Writer Card/Cable + Software To Suit IBM-Compatible Computers	**$39.95**

Mail Order Hot-Line
B/Card-Mast/Card-Visa-Cheque
Phone (03) 484 0191

PCB faults & shorts locator from Emona Instruments

The Polar 850 shorts locator allows you to pinpoint short circuits on PC boards in a fraction of the time it normally takes. By locating solder bridges, etching defects, faulty ICs or faulty decoupling capacitors, the 850 also eliminates the need to cut tracks to isolate the fault.

Three different techniques are employed to track down short circuits. 2MΩ, 40MΩ and 200MΩ ranges allow shorts to be located between PC tracks or component legs by finding the point of minimum resistance. For higher resistance faults, a 2mV range with 1μV resolution allows the tracing of current flow along tracks. Finally, a magnetic field sensing current probe traces current along inaccessible paths such as through ICs or through buried tracks in multi-layer PC boards.

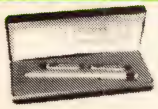


A variable pitch tone and a digital display are used to guide the user to the shorted location. For more information, contact Mark Breznik at Emona Instruments, 86 Parramatta Rd, Camperdown, NSW 2050. Phone (02) 519 .3933. **SC**

MAY MADNESS

$3 CERTIFIED P&P ANY OR AS MANY ITEMS FROM THIS PAGE

VISIBLE LASER DIODE POINTER-PEN



Suit teachers, doctors, businessmen, and other professionals. Improve and enhance all your presentations. Not a kit, but a complete commercial pen sized laser pointer at an incredible introductory price!

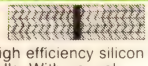
ONLY $199

Small pen sized body. Runs on two small AAA battery. Battery life: 2-10 hours. Visible 5mW red (670nM) laser. Projects a visible red spot at more than 50 metres. As used for medical treatment by some doctors and acupuncturists.

DIVERGING LENS

A high quality laser beam diverging (beam expander) glass lens, mounted on an aluminium plate, with mounting screws provided. Dimensions: 25 X 25 X 6mm. Use it to expand the laser beam for Holography, Special Effects, or one of the two lenses required to fine focus a laser beam, for Surveying and Bar Code Reading. $9.90

SILICON SOLAR CELLS



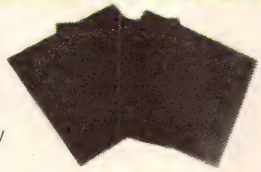
High efficiency silicon cells. With normal sunlight, and under load, each one of these 12.5 X 50mm cells will deliver 0.46V at approximately 175mA: V o/c = 0.58V, I s/c = 188mA. Glass from a very small picture frame, and some silicon could be used to make a 6V / 1.1W (14 cells) or a 12V / 2.2W (28 cells) solar panel! Pretinned connecting solder connections are provided.

ONLY $1 ea.

EXPERIMENTAL E.H.T. POWER SUPPLY

ON SPECIAL $29.90

SOLAR PANEL GIVEAWAY



Brand New high quality US made, amophourous glass Solar Panels. Dimensions: 150 X 150 X 2.5mm. In normal sunlight they deliver a full 1 Watt whilst charging 6V-8V batteries! Can be connected in series, in parallel, or series / parallel, to increase the voltage, and/or current capacity. For example, in average sunlight, two of these panels connected in series will deliver approximately 150mA of charging current, into a floating 12V (14V) battery: 2 Watts! Four panels can be connected in series parallel to deliver 300mA into a floating battery: 4 Watts! Compare the prices! All the panels have a weather protection film on rear, and the terminating clips are provided.

INCREDIBLE PRICING: $9 ea. or 10 for $75

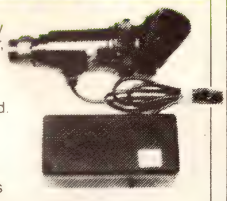
LASER GUNSIGHT

Small black anodised metal body. Removable pressure switch. Vertical and horizontal adjustments. Battery life more than 10 hours continuous. 5mW 670nM class IIIA laser. Range is about 150m, some would claim three times more. Shock tested to 2000g. One year warranty.

ONLY $299

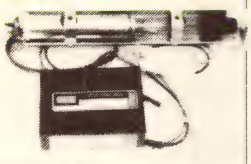
Price includes one rifle or pistol mount

NIGHT VIEWER BARGAIN



A very small telescopic monocular IR viewer. Actually ½ of the IR Binocular Viewer, advertised elsewhere in this advertisement. Very small: Length of scope is 130mm without the rubber hood fitted. The assembled scope has high quality military grade optics, and employs a prefocussed IR image converter tube. This tube has a useful response from 600-1300 nM, thus also making it useful when working with IR LEDs, and IR laser systems. The scope has provision for a coaxial E.H.T. connection, and is supplied with a power supply kit, that features a ready assembled inverter on a small PCB. The power supply easily fits into a small plastic case, and can be fitted with a belt clip: Also supplied! At a very small fraction of its real value! Worth $200. $239

MAINS OPERATED LASER



Consider this Mains Powered Laser Bargain, for discos, laboratories, photography, holography, medical field, etc. Supplied with two 3mW Seimens tubes, and a brand new potted mains laser power supply. The tubes are used but have plenty of life left in them. They are Guaranteed! $189

We can also supply the mains laser supplies with lower powered tube, at a slightly lower cost. **Ring or fax.**

KIT SPECIALS

ULTRASONIC CAR ALARM

Crystal locked ultrasonic movement detector and/or a self standing car alarm. Provision for bonnet/boot protection and battery back up. See S.C. May '88. The kit includes the PCB and components, the ultrasonic transducers, but the screw terminals are not provided.

CLEARANCE AT $24.90

THE MICROPHONE

This unit has a built in preamplifier so it can drive any amplifier. Turn your stereo amplifier into a PA amplifier. Also features touch switching, battery check function, etc.

See E.A. Nov. '86.

CLEARANCE AT $19.90

3mW GAS LASER

Includes high quality low divergence Siemens laser head with an output at about 3mW and one of our reliable and efficient 12V universal laser power supply kits. The tube is used but it is guaranteed. The kit comes with full instructions and it even includes a prewound transformer. The applications include high power laser pointers, surveying equipment, optical experiments, education, holography, medical field, disco displays, etc. ONLY $99

INFRA RED FILTER

A high quality, military grade, deep infra red (IR) filter. For medium and high power incadescent spotlights and flood lights. Approximately 130mm diameter and 6mm thick. High temperature pyrex-glass base material. Excellent for night surveillance equipment! Works with IR viewers and some video equipment.

ON SPECIAL $55

VISIBLE LASER DIODE HEAD

Save, by making your own laser pointer, laser gun sight, medical treatment laser, etc. Produces a well collimated beam. Designed to be powered directly from a 3V battery, or from higher voltages, if a simple constant source is added. Simple circuit included. 5mW (670nM). At an incredible introductory price of: $135

For the head only: Add $8 for the extra "bits" needed to make a complete laser diode pointer. Case, switch, alkaline batteries, and battery holders. Everything you need to make a complete, self contained, visible laser pointer or gunsight.

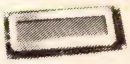
ARGON LASER

These air cooled Argon Laser Heads have had relatively "low hours" of operation. They are guaranteed. They produce a bright blue beam (488nM) and have a power output in the 10-100mW range. Limited supplies, at a small fraction of their real value.

ONLY $800

The head includes power meter circuitry and starting circuitry. Circuit diagram provided. Also provided is a circuit for a simple power supply. We can provide the major components for this supply. Enquire.

LCD DISPLAY MODULE



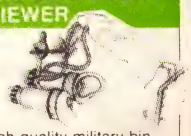
These are brand new 16 character by 2 line modules (16 X 2), has backlighting provision. High quality, high contrast, alphanumeric LCD display modules, with surface mounted control circuitry already mounted underneath the PCB. Require a few millamperes at 5V to operate. We include information.

ON SPECIAL AT $18 ea.

LENS ASSEMBLY

This plastic lens assembly includes a lens with an approximate diameter of 12mm, whose focal point is about ½ the length of the cylindrical tube, which is 20mm long. Mounting holes provided. Great for housing and improving the sensitivity of any light and laser detectors. $5.50

I.R. BINOCULAR VIEWER



High quality military binocular IR viewer. Self powered, and originally intended to be mounted on a helmet. Focus is adjustable from 1 metre to infinity. Requires some IR illumination. Powered by one single 1.5V battery. Original fibreglass carry case provided. Limited stock. $649

IR LASERS

This precision collimator assembly was removed from working laser printers, but is supplied with an extra Brand New laser diode to suit. It produces a beam that can be focussed to a fine dot or line. Barely visible. 780 nM/5mW. We also supply a PCB components and instructions kit, for a suitable digital driver circuit that can be used to complete the laser transmitter. Suitable for communications, data links, perimeter protection, bar code reading, medical, etc. Limited stocks. $89

LASERS are not for kids: DANGER

Melbourne Distributor: Electronics World
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Fax: (02) 570 7910
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Build this telephone intercom

Do you have a couple of old telephones sitting in your junkbox? This simple project will turn them into a useful intercom unit that works just like a real telephone system.

By GREIG SHERIDAN

Ever wondered how Commissioner Gordon managed to raise Batman so effortlessly on the hotline? Or have you ever been curious to know how the White House-Kremlin hotline works?

Both systems are probably very similar in concept to this telephone intercom – ordinary telephones connected to 2-wire lines and featuring full-duplex operation (ie, simultaneous 2-way conversation). As well, this unit is simple to drive, easy to build and doesn't cost the earth!

As well as an intercom, this interface is capable of testing telephones, modems, DTMF decoders and facsimile and answering machines. It is also ideal for theatrical applications.

A stripped-down version could also be used to make role-playing training sessions more realistic at telephone counselling services. In fact, this is the purpose for which the circuit was initially designed.

Telephones – an introduction

A telephone in its on-hook (hung up) state exhibits a capacitance and series resistance between both legs of the line. This is the ringing circuit – see Fig.1. An AC ringing signal will pass and cause the bells to ring or the "tone ringer" to warble.

When the phone is taken off-hook, a DC loop (mainly resistive) is applied to the line and DC flows, fed from the exchange. The exchange equipment detects this current flow and either stops the ringing signal (for an incoming call) or sends dial tone (if it's an outgoing call attempt).

When a phone is rung, the ringing signal is connected to one leg of the line and the return path is through

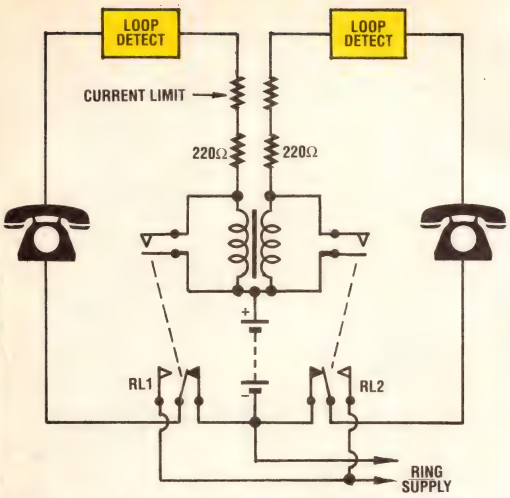

Fig.1: the basic telephone ringing circuit. When one phone is taken off-hook, the ring relays in the other loop close & a ringing signal is applied to the second phone.

the DC supply. The idle line voltage is usually around 48V, although this is not critical.

When the phone handset is off-hook, a current of 20-30mA flows. This is sufficient to power the phone's transmitter (microphone), whether it is a modern electronic type with an in-built preamplifier or the original carbon granule type.

This loop current also powers any dialling circuitry where appropriate.

This circuit emulates the above conditions, which makes it compatible with just about all types of telephone. However, there are a couple of deviations from standard telephone practice.

First, the circuit described here uses a negative earth whereas telecommunications equipment generally runs on a positive earth. This convention was chosen to minimise electrolytic action in earth stakes and the like but as this is not applicable here, it has been omitted. Besides, I hate trying to think and design for a positive earth.

The ring voltage and frequency have also been altered to keep the project easy to build and the cost as low as possible. The normal exchange ring signal is 75-90V RMS at 25Hz but, by experimentation, it has been found that this voltage and frequency are only required when driving older telephones with real bells.

Modern telephones usually rectify the incoming ring signal and regulate it to about 12V, which then becomes the power supply for the ringer chip. So, for these phones, the ring voltage and frequency are not critical.

For applications where a higher ring voltage is required (generally the 800 series phones and their Bakelite predecessors), a larger ring transformer can be used.

As well as the Arlec 75XXX and Knowhow 7VA transformers, the circuit board has been designed to accept the Farnell 150-07X 6VA series. The Farnell 24-0-24 (150-076) rings an 800 series telephone much more convincingly.

For those who want to go over the top, replace the power supply shown here with an ex-Telecom 50V supply (complete with 75V ring). These supplies occasionally pop up at electronics disposals stores for a fraction of their "new" value.

To operate the intercom, you simply lift one phone and the other phone rings. Lifting the second phone then stops the ringing and conversation can commence.

The circuit does not reset until both telephone handsets are replaced. This prevents the first phone to be hung up from ringing until the second phone "clears". It also allows one party to hang up and continue the conversation on another extension on the line.

Circuit details

Fig.2 shows the full circuit details. All the required voltages are derived from two power transformers. One transformer (T1) provides a +12V rail (via D5 and a 3-terminal regulator) for the logic and around 46V DC for the telephone "speech" voltage. The second transformer (T2) produces around 90V peak-to-peak (nominally 30V RMS) for the ring signal.

The whole circuit uses only four CMOS chips and two optoisolators to provide the logic and generate the required ringing signal. Let's see how it works.

Schmitt inverter stages IC1a & IC1b provide buffering and false triggering protection for phone 1. In the idle state, there is no DC flowing in the phone line and so the LED in the associated optoisolator (IC5) is off. IC1a's input is thus held high, which means that pin 12 of IC1b is also high.

Similarly, if phone 2 is on-hook, pin 10 of IC1d will be high. These logic highs are fed to pins 5 & 6 of

PARTS LIST

1 metal case, 256 x 155 x 76mm (W x D x H)
1 PC board, code SC12105921, 132 x 102mm
1 PC board, code SC12105922, 105 x 103mm
1 mains cord & 3-pin plug
2 15-0-15V 7VA PC-mounting transformers (see note 1)
1 600:600 ohm transformer (Arlec 45035, Altronics M-1000, Jaycar MA-1510).
2 12V DPDT relays (Jaycar SY-4061 or Altronics S-4165)
2 LED bezels
1 4-way screw terminal panel
1 100kΩ 10mm horizontal trimpot
19 PC stakes
1 cordgrip grommet
1 solder lug

Semiconductors
1 74C14/40106 hex Schmitt inverter (IC1)
1 4081B quad AND gate (IC2)
1 4001B quad NOR gate (IC3)
1 4017B decade counter (IC4)
2 4N25 optoisolators (IC5,IC6)
4 BC547 NPN transistors (Q1,Q2,Q3,Q5)
1 BC557 PNP transistor (Q4)
7 1N4004 diodes (D1-D7)
4 1N914/1N4148 diodes (D8-D11)
2 3.3V 1W zener diodes (ZD1, ZD2)
1 5mm green LED (LED 1)
1 5mm orange LED (LED 2)

Capacitors
1 3300µF 63V PC electrolytic
1 1000µF 35V PC electrolytic
2 10µF 25V PC electrolytic
3 1µF 25V PC electrolytic

Resistors (0.5W, 1%)

3 100kΩ	2 680Ω
2 47kΩ	3 220Ω
6 10kΩ	2 150Ω
2 1.2kΩ 1W	

Miscellaneous
Machine screws, nuts & washers; hook-up wire; two telephones; 2-way telephone cable.

Note 1: if a higher ring voltage is required, use a 24-0-24V transformer (eg, Farnell 150-076) for the ring supply instead of one of the specified 15-0-15V transformers.

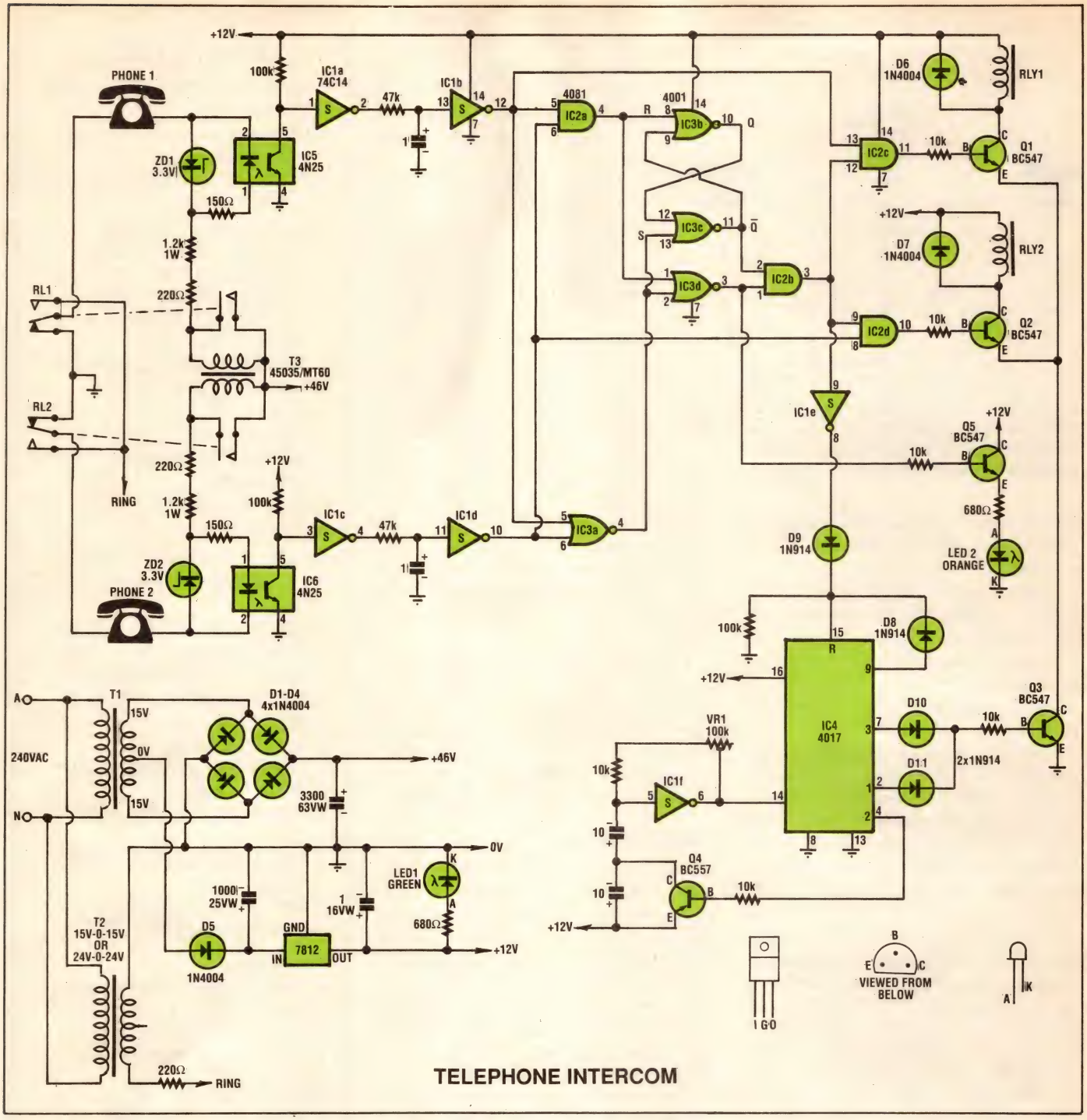

Fig.2: the final circuit uses optoisolators IC5 & IC6 to isolate the ring circuits from the control logic. When one phone is taken off-hook, then either Q1 or Q2 turns on to activate the ring relay in the other circuit. Transformer T2 provides the ring signal, while IC4 & its associated parts generate the ring sequence.

AND gate IC2a, to pins 5 & 6 of NOR gate IC3a, to pin 13 of IC2c, and to pin 8 of IC2d.

Assuming that both phones are initially idle (ie, on-hook), the output of IC2a will also be high. This holds the RS flipflop formed by IC3b & IC3c in its reset state, with "Q" low & "Q-bar" high. The Set input of the RS flipflop (pin 13 of IC3c) is fed from pin 4 of IC3a which is currently at logic 0.

If phone 1 is taken off-hook, current flows through the LED in optoisolator IC5 and turns on the internal transistor. This pulls pin 1 of IC1a low and thus the previous high on the reset of the flipflop is also toggled low (via IC1b & IC2a), which means that the flipflop can now be toggled.

Similarly, if phone 2 is taken off-hook, pin 3 of IC1c goes low and toggles the Reset of the flipflop low via IC1d & IC2a.

IC3d detects any difference between the states of the two phones. When a difference is detected (ie, when one phone is taken off-hook), its output at pin 3 goes high and turns on LED 1 via transistor Q5 (actually, IC2a, IC3a & IC3d together form an XOR gate to detect the different phone states).

TABLE 1

Symptom	Possible Fault
No sidetone in either phone	Is green "power-on" LED lit? Check all voltages. If either +12V or +46V rail missing, switch off & disconnect the logic PC board from the supply. Power up & check the supply rails again. If supply rail(s) still missing, check the supply board; if supply rails now correct, check for a short on the logic board.
No sidetone in one phone only	(1). Check that the associated 220-ohm protection resistor in the loop circuit has not burnt out. (2). Do cabling & telephone test OK? Check by swapping phone lines over on the back of the interface. If the same phone still has no sidetone, then the fault is either in the phone itself or in the cable.
No ring to either phone	(1). Check that the 220-ohm ring protect resistor (connected to transformer T2) has not burnt out due to excessive current. Check the loop circuitry carefully before replacing this resistor. (2). Are interrupted ring counter IC4 & transistor Q3 operating? Test by earthing collector of Q3. (3). Check that the orange LED (LED 2) is off when both phones are on-hook. If LED is on & logic circuitry is OK, then one phone is faulty or there is a cabling fault. Test this by removing the wires from the interface.
No ring to one phone	(1). Check ring supply voltage from transformer T2. (2). Is associated ring relay (RLY1 or RLY2) operating? If phone 1 does not ring, check for high on pin 11 of IC2c. If pin 11 high, suspect switching transistor Q1 & RLY1. If phone 2 does not ring, check for high on pin 10 of IC2d. If pin 10 high, suspect Q2 & RLY2.

In addition, when IC3d's output goes high, pin 3 of IC2b also goes high. Depending on which phone was taken off-hook, then pin 11 of IC2c or pin 10 of IC2d will switch high. (Note: IC2 is a 4081 quad 2-input AND gate. When both inputs of these AND gates are high, the gate output will be high).

Let's assume that phone 1 has been taken off-hook. In this case, pin 10 of IC2d switches high and forward biases Q2. Q2 then subsequently turns on and activates ring relay RLY2 whenever Q3 in the ring circuit turns on.

Similarly, if phone 2 is taken off-hook first, pin 11 of IC2c switches high and forward biases Q1.

In other words, taking phone 1 off-hook closes RLY2 and rings the bell on the other phone. And vice versa.

Ring circuit

Counter stage IC4 (4017) and its associated parts form the ring timer circuit. It is normally held reset by IC1e but is activated when pin 3 of IC2b goes high and pin 8 of IC1e switches low. This ensures that the counter is only one "clock tick" off the beginning the ringing cycle, rather than having to wait for possibly up to two seconds for the ringing cycle to begin.

IC4 is clocked by Schmitt oscillator stage IC1f and turns on Q3 and ring relay RLY2 each time its "1" and "3" outputs go high. It also switches interrupt transistor Q3 (via its "2" output) to generate the required ring cadence. The exact operation of the ring cadence generator is described a little further on.

Each time RLY2 operates, its contacts close and the AC ring signal from transformer T2 flows through phone 2, ZD2, the series 1.2kΩ and 220Ω resistors, and the 3300μF filter capacitor on the +48V supply rail.

If the calling phone now goes back on-hook, pin 3 of IC3d goes low again and the circuit reverts to the idle condition. Alternatively, if the called party answers, pin 4 of IC3a goes high and toggles the flipflop (IC3b & IC3c). This sets Q-bar of the flipflop (pin 11 of IC3c) low, which in turn switches pin 3 of IC2b low and stops the ring.

Conversation can now proceed,

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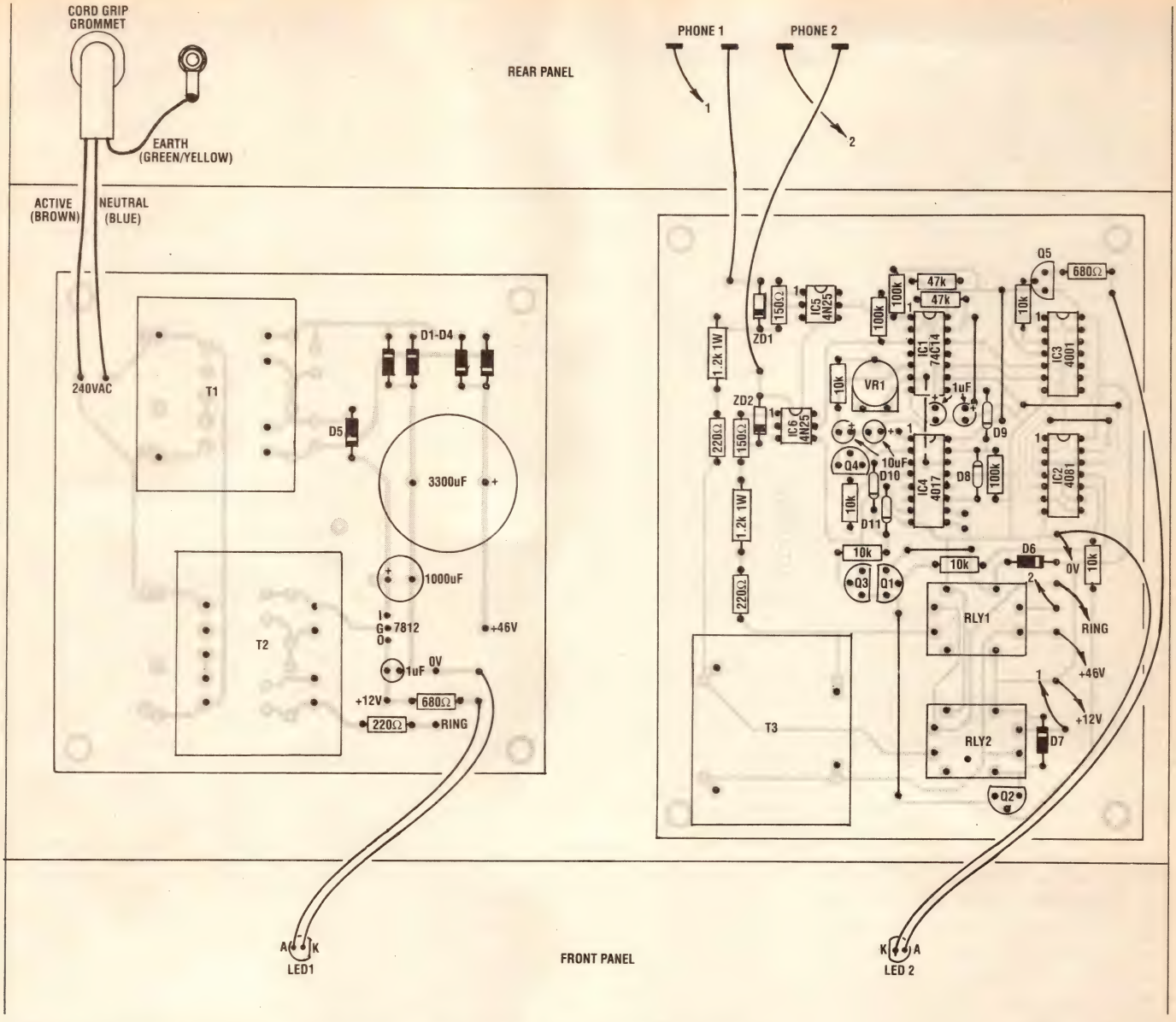


Fig.3: this diagram shows how the parts are installed on the PC boards. Note that the two 1.2kΩ 1W resistors on the logic board are soldered to PC stakes (see text). The two boards are connected together using 4-way telephone cable.

with the audio signal coupled by the 600:600 ohm transformer (T3).

When one party subsequently replaces the handset, pin 3 of IC3d will go high and attempt to ring the idle phone. Ringing will not proceed, however, because the flipflop is set (Q-bar low), thus depriving IC2b of the required logic high.

The flipflop remains set until both handsets are replaced and IC2a resets the logic to its standby state, ready for another call attempt.

Ring sequence

The ring cadence can be easily customised to suit your application. Some constructors may choose to build the unit as close to the Australian standard as possible, whereas others may opt for an "American-sounding" ring, or some other sequence.

The standard ring cycle that we are familiar with has the following pattern: 400ms on, 200ms off, 400ms on, 2s off, and so on.

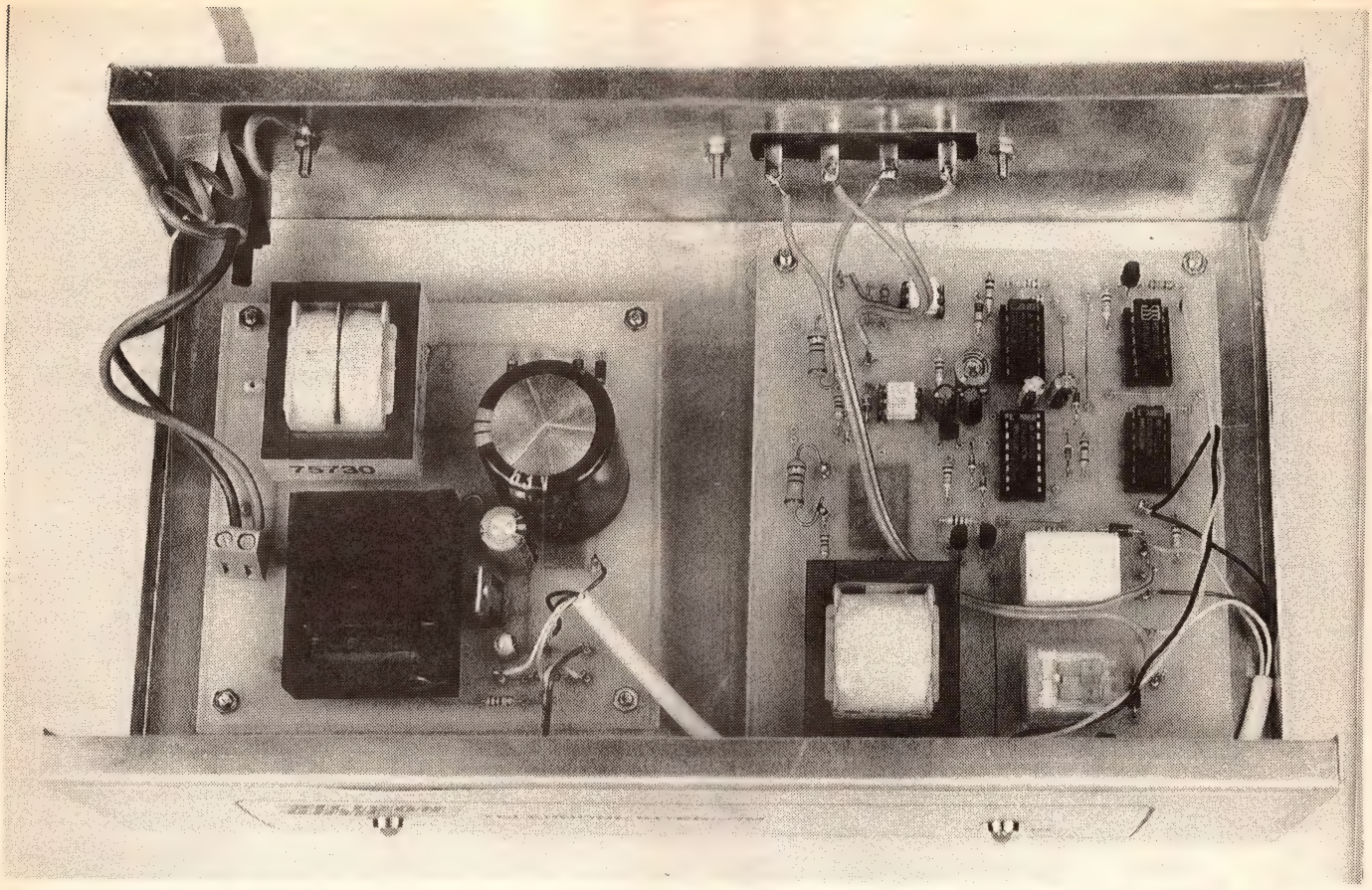
To generate this sequence, we would normally require a 200ms clock period and a counter with 15 outputs (ie, we would have to use two counter ICs in cascade). Another way is to use a single standard decade counter, the 4017, and add logic to make it suit the application.

In this circuit, the 4017 (IC4) is fed from a 2.5Hz clock (IC1f) which provides a period of 400ms per step. However, as the output corresponding to the 200ms "off" period goes high (output "2", pin 4), the clock is doubled in speed to give the required 200ms period.

This is easily accomplished using PNP transistor Q4 and the 10µF capacitor wired between its emitter and collector.

In operation, Q4 is normally conducting and the 10µF capacitor across it is short circuited. However, when output "2" (pin 4) of IC4 goes high, it turns off Q4 and this switches the 10µF capacitor in series with an existing 10µF capacitor in the clock's timing circuit.

Because the two capacitors are in series and of the same value, the total capacitance seen by IC1f is now



The two PC boards are housed in a metal case & secured on 5mm spacers using machine screws & nuts. The screw terminals on the rear panel provide the connections for the lines to each telephone.

halved. The clock therefore doubles its frequency, giving one 200ms burst to step the counter past output "2". When output "3" goes high, Q4 turns back on again and the clock reverts to its 400ms period.

Diode D8 resets the counter when output "9" (pin 11) goes high to limit the off period to 2s following the second 400ms ring. The ring sequence is then repeated.

Although Fig.2 shows the circuit arrangement for the Australian ring standard, you can easily customise the ring to suit your own requirements. For example, the clock frequency can be adjusted over a wide range using VR1, or the ringing sequence can be changed by using different counter outputs.

If you don't require the standard "ring-ring" cadence, omit Q4 and replace the 10µF capacitor between its emitter and collector with a wire link.

Construction

Construction is straightforward, with most of the parts accommodated on two PC boards. One board (code SC12105921) carries all the logic circuitry, while the second board (code SC12105922) carries the power supply components.

Before mounting any of the parts, check the circuit boards for undrilled holes and damaged tracks. In particular, check the logic board around IC2 & IC3, since the tracks here are very fine. Check also that the mounting holes and the holes for the transformers, filter capacitor, relays, PC stakes and trimpot are large enough.

Fig.3 shows the wiring details. Begin by installing PC stakes at all exter-

TABLE 1: RESISTOR COLOUR CODES

❑	No.	Value	4-Band Code (1%)	5-Band Code (1%)
❑	3	100kΩ	brown black yellow brown	brown black black orange brown
❑	2	47kΩ	yellow violet orange brown	yellow violet black red brown
❑	6	10kΩ	brown black orange brown	brown black black red brown
❑	2	1.2kΩ	brown red red brown	brown red black brown brown
❑	2	680Ω	blue grey brown brown	blue grey black black brown
❑	3	220Ω	red red brown brown	red red black black brown
❑	2	150Ω	brown green brown brown	green black black brown

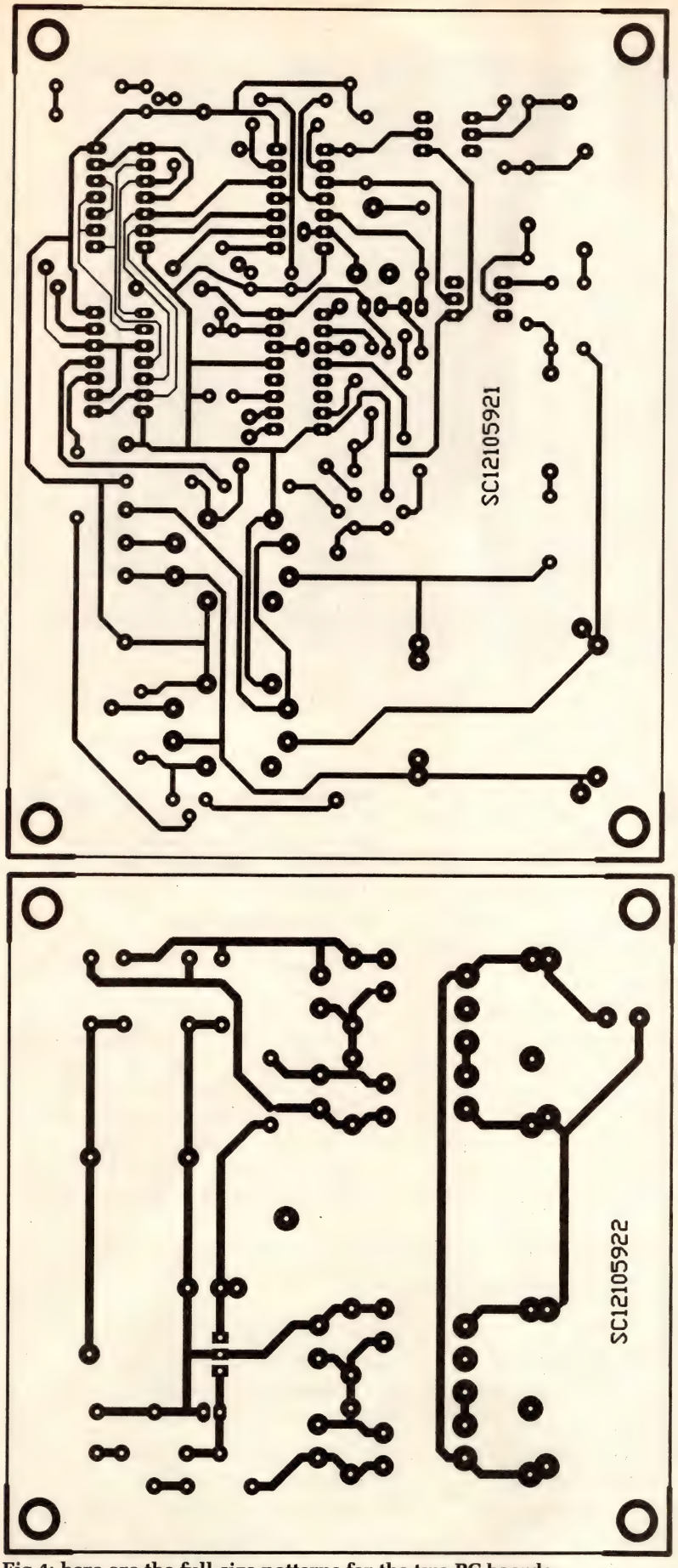


Fig.4: here are the full-size patterns for the two PC boards.

nal wiring points on the power supply board, then fit the 7812 voltage regulator, capacitors and transformers. Take care with the orientation of the voltage regulator – see Fig.2 for the pin connection details.

Moving now to the logic board, install the five wire links before mounting any of the other parts (one link runs underneath two ICs). Once these are in, fit PC stakes to the external wiring points and install the remaining parts as shown, leaving the relays and transformer until last.

Note that you should also fit PC stakes at the mounting points for the two 1.2kΩ current limiting resistors (in series with ZD1 & ZD2), since these values may have to be adjusted when the circuit is operational.

The prototype was housed in a metal case measuring 256 x 76 x 155mm and fitted with an adhesive aluminium label. After attaching the label, drill mounting holes in the front panel for the two LEDs, then drill the rear panel to accept the mains cordgrip grommet, an earth lug mounting screw and the screw terminals for the telephone lines.

The two PC boards can be used as templates to mark out their mounting holes on the bottom of the case. Once the holes have been drilled, secure the mains cord to the case using the cordgrip grommet and solder the Active (brown) and Neutral (blue) leads to the power supply board.

The Earth lead (green/yellow) is connected to the earth lug on the rear panel. This lead should be made longer than the Active and Neutral leads, so that it will be the last to break if the cordgrip grommet comes adrift.

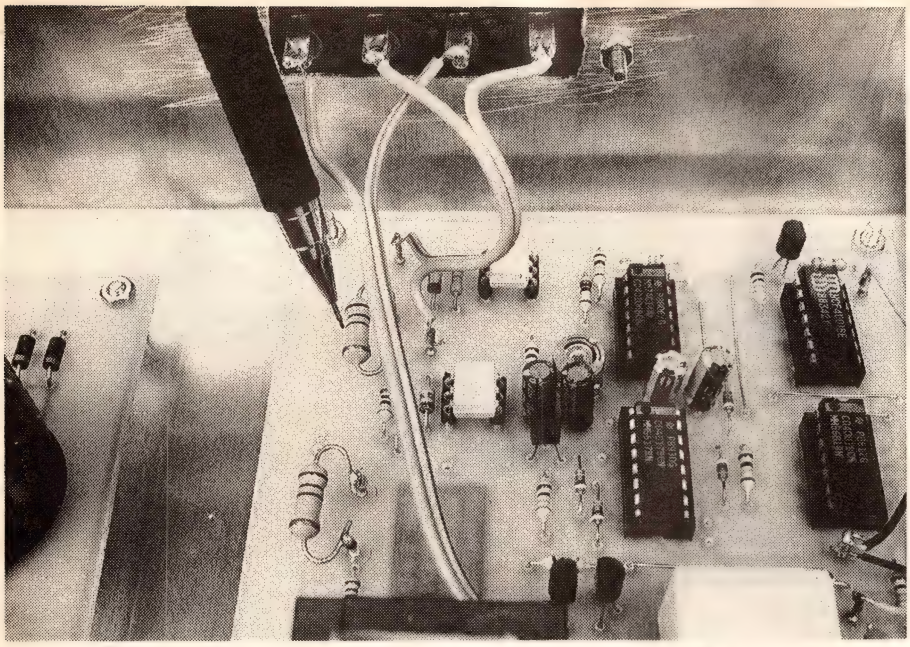
Once the mains wiring has been completed, mount the two boards in the case on 5mm standoffs and secure them using screws, nuts and star washers. The remainder of the wiring can now be completed as shown in Fig.3. This includes a 4-wire connection between the two boards, plus wiring from the logic board to the front and rear panels.

Testing

Before applying power, go over the project carefully and check for wiring errors. In particular, check that all parts are correctly oriented and that the mains cord is securely held by the cordgrip grommet.

When you are satisfied that everything is correct, switch on and check the supply voltages. The output of the 7812 regulator should be at +12V, as should pin 14 of IC1, IC2 and IC3, and pin 16 of IC4. The positive terminal of the 3300µF filter capacitor should be at about +46V.

Exercise caution when making these measurements, as mains voltages are present



The two 1.2kΩ 1W loop current limiting resistors may have to be reduced in value for telephone lines of considerable length. Generally, you should aim for loop currents of 10-25mA. You can check this current by connecting your multimeter across each telephone while it is on-hook.

on the underside of the power supply board.

Assuming that the supply voltages check out, short pins 4 and 5 of one of the optoisolators (IC5 or IC6). One of ring relays should now begin operating, according to the programmed ring sequence.

Trimpot VR1 can now be adjusted to give the correct clock period. If you want to simulate the Australian ring standard, just adjust VR1 so that each complete ring cycle lasts three seconds (ie, 400ms on, 200ms off, 400ms on, 2s off). Alternatively, you can connect the two telephones to the circuit, take one of them off-hook, and adjust VR1 until you get the correct "sound".

Fig.5 (below): this full-size artwork can be used as a drilling template for the front panel.

Installation

The values of the current limiting resistors in series with ZD1 and ZD2 may have to be adjusted according to the lengths of the individual lines. Generally, a loop current of 30mA should be considered the maximum.

For most in-house or house-to-garage use, 1.2kΩ 1W resistors (as shown on Fig.2) will do the job. However, lines of considerable length require lower value resistors because the resistance of the cable itself provides a certain amount of current limiting.

If built solely for use as an intercom, the loop current can possibly be reduced to as low as 10mA. The benefits of lower loop current include longer operating distances and extended life for carbon granule type transmitters. The level of sidetone (ie, the level at which you hear your own voice) is also be reduced.

Of the phones tested, many gave reliable communication with as little as 10mA of loop current, although one Siemens model would not send DTMF tones from its keypad until it had about 25mA flowing.

Fault finding

If you strike problems, first check that all ICs have +12V on their supply pins. You should also check the boards for missed solder joints and for solder shorts between adjacent IC pins (make sure that the power is off).

Next, trace through the gates with a logic probe or a digital voltmeter to check that the input logic is operating correctly. Check that pin 12 of IC1b, pin 10 of IC1d and pin 4 of IC2 are all high when both phones are on-hook. Pin 4 of IC2a should switch low when one phone is taken off-hook.

If you don't get the correct readings here, check the optoisolators and the input buffering circuitry (IC1a-IC1d).

Table 1 lists a number of possible symptoms and their likely causes. By following this table carefully, you should have little difficulty in tracking down any likely faults.

References

(1). Telephony, Volumes 1-5. Postmaster-General's Department, Australia.
(2). Telephony and Telegraphy. Sydney F. Smith. Oxford University Press.

Caution

This intercom must not be connected to Telecom lines. It is intended only for use on lines completely separate from Telecom installations.

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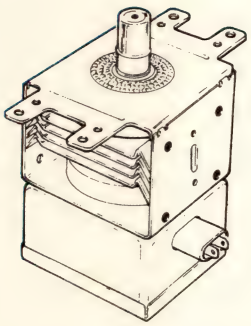

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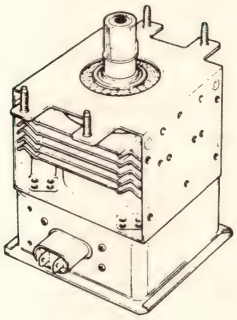

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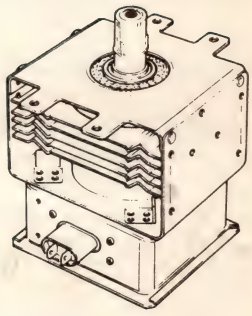

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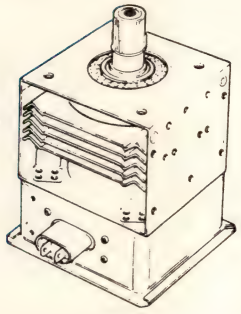

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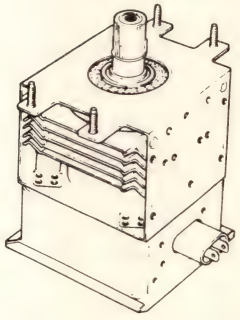

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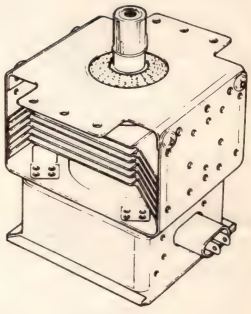

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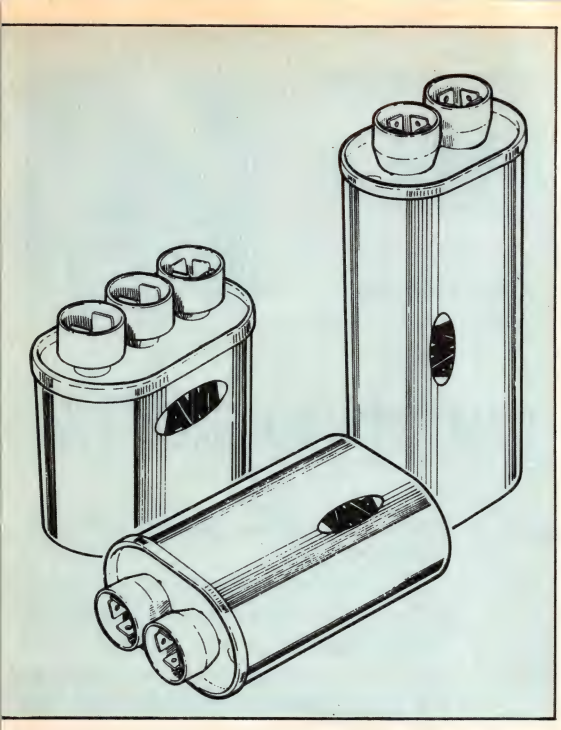
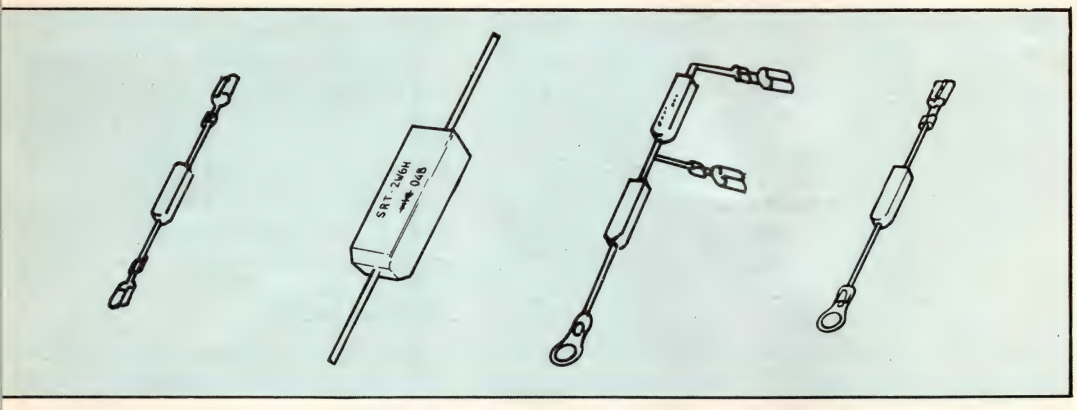


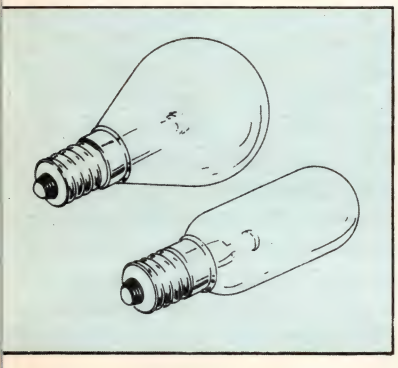
Microwave Ovens

These capacitors are used in voltage doubler circuits in high voltage microwave oven transformers. In these applications, the capacitor must be capable of withstanding an AC voltage equal to twice the peak voltage of the transformer output voltage.

Oval Metal Case* 1700-2600VAC Typical Sizes for Ratings at 70-90°C Case Temperature						
P/N	CAPACITANCE	VOLTAGE		BASE SIZE IN.	CASE HEIGHT 'H' IN.	mm
N50H1770G	0.70	1700		1.25	2.50	63.5
N50H2170G	0.70	2100		1.25	3.31	84.0
N50H2570G	0.70	2500	A	1.25	3.75	95.3
N50H1775G	0.75	1700		1.25	2.50	63.5
N50H2175G	0.75	2100	A	1.25	3.31	84.0
N50H2575G	0.75	2500	A	1.25	4.25	108.0
N50H1780G	0.80	1700		1.25	2.50	63.5
N50H2180G	0.80	2100		1.25	3.31	84.0
N50H2580G	0.80	2500		1.25	4.25	108.0
N50H1785G	0.85	1700		1.25	3.00	76.2
N50H1785G	0.85	2100	A	1.25	3.31	84.0
N50H2585G	0.85	2500	A	1.25	4.25	108.0
N50H1790G	0.90	1700		1.25	3.00	76.2
N50H2190G	0.90	2100	A	1.25	3.31	84.0
N50H2590G	0.90	2500	A	1.25	4.75	120.7
N50H1795G	0.95	1700		1.25	3.00	76.2
N50H2195G	0.95	2100	A	1.25	3.31	84.0
N50H2595G	0.95	2500	A	1.25	4.75	120.7
N50H1710G	1.00	1700		1.25	3.00	76.2
N50H1710G	1.00	2100	A	1.25	3.31	84.0
N50H2510G	1.00	2500	A	1.25	4.75	120.7
N50H1710G	1.05	1700		1.25	3.00	76.2
N50H2110G	1.05	2100	A	1.25	4.00	101.6
N50H1711G	1.10	1700		1.25	3.00	76.2
N50H2111G	1.10	2100	A	1.25	4.00	101.6
N50H1712G	1.20	1700		1.25	3.13	79.5
N50H2112G	1.20	2100		1.25	4.00	101.6
Typical Sizes for Dual Capacitance Ratings						
N64H2295G	0.67 + 0.28	2200	A	1.75	2.56	68
N64H2210G	0.70 + 0.33	2200		1.75	2.56	68
N64H2512G	0.90 + 0.48	2500		1.75	4.06	102

A - Denotes stock items
Non-listed items - Delivery on application





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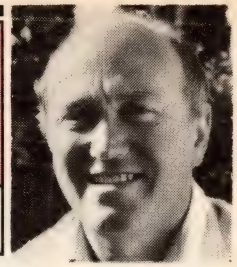
VINTAGE RADIO

By JOHN HILL



Aligning vintage radio receivers, Pt.2

Last month's Vintage Radio column covered the various components involved in receiver alignment. We now move on to the equipment used for alignment and describe how it is used.

It is both easier and quicker to align a superhet receiver if you have the right equipment. The right equipment in this case is a radio frequency (signal) generator and an output meter. However, as these instruments are not always available, we will also describe the alignment procedure without them.

Signal generators

A signal generator does exactly what its name implies – it generates RF signals which can be injected into a radio receiver at various points. It is usual to modulate the RF signal with an audible frequency of around 400-1000Hz, so that the signal can be heard in the receiver's loudspeaker. Signal generators are tunable and any desired frequency can be obtained simply by selecting a frequency range and setting a calibrated dial.

Modulating the RF signal with an audible tone is similar to what happens at a radio station's transmitter, where the radio frequency signal (carrier) is modulated by audio frequencies (speech, music, etc). A simple way of looking at this is to think of the RF signal as the vehicle and the audio frequency signal as the passenger. The receiver is designed to receive, amplify and separate the two signals, for it is only the passenger that is of interest in the end.

Likewise with the signal generator. It is of little use injecting a radio frequency signal into a receiver if we cannot monitor it. If we modulate the RF signal with an audio signal, we can both hear it and see its strength on an output meter.

The main advantage of using a signal generator is that it supplies a constant and stable signal at any chosen frequency. Also, its amplitude can be varied as appropriate during the various alignment stages, thus making it more convenient to use than a distant radio station.

An RF (signal) generator and an output meter make the task of receiver alignment much easier. This photo shows a Heathkit RF signal generator and a standard multimeter.

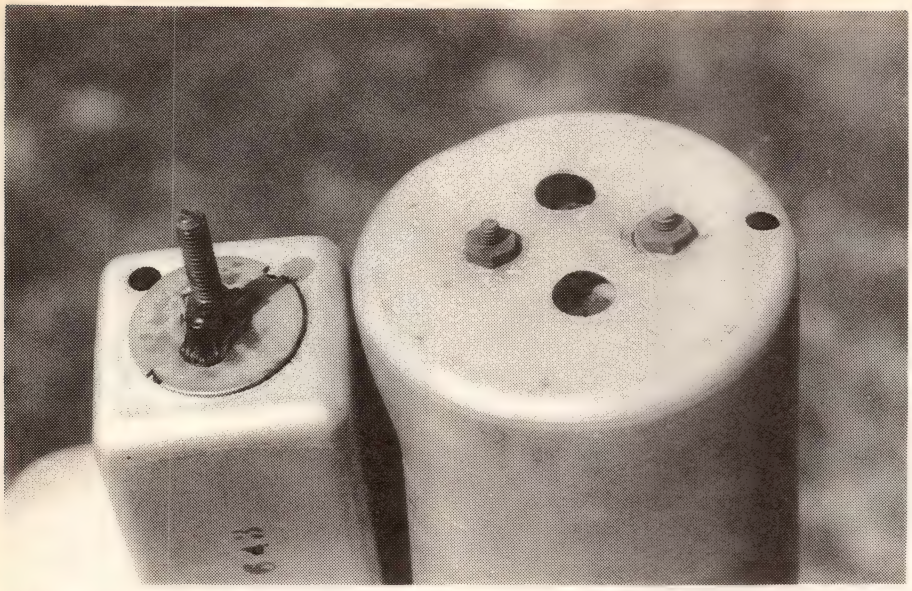
Output meter

An output meter is used to measure the output signal strength of the receiver being aligned. Its two leads are usually connected to the anode of the output valve and to the chassis. In some cases, it can be connected across the loudspeaker's voice coil but this method is not successful unless the meter is particularly sensitive.

Some multimeters have a special output socket (to accept the lead connected to the output valve anode) but, unfortunately, many lack this refinement, which makes things a little more difficult. However, any multimeter with an AC volts range can be easily adapted for use as an output meter.

To explain, not all voltages are pure AC or DC – some can be a mixture of both. In the case of an output valve, the AC audio signal which drives the loudspeaker is superimposed on a DC voltage of about 250V which is applied to the valve's anode. An output meter is designed to ignore this DC voltage and display the AC (audio) component only.

This seemingly difficult task is easily accomplished by placing a high



IF transformers are adjusted by one of two means – either by using trimmer capacitors, as shown at right, or by adjustable iron slugs (left). Some early transformers may only have one adjustment instead of the usual two.

voltage capacitor (of about .047µF, or larger) in series with one of the meter leads. This capacitor blocks the DC voltage but allows the AC voltage to register on the meter.

Therefore, any multimeter with AC ranges can be used as an output meter by making up a special lead with a suitable capacitor in series with it. Such a lead requires a small insulated alligator clip at one end and a banana plug or whatever to suit the meter socket at the other end. The capacitor connections must be well insulated.

If you have a multimeter with an output socket, the blocking capacitor is already built into the meter. However, it is advisable to check this capacitor. Either check the circuit for specification or open the back of the multimeter and have a look. The capacitor must have at least a 400V rating and should ideally be a modern plastic type if it is to be used on valve receivers.

I speak from experience. The only meter I have with an output socket has already blown its original 400V capacitor and now has a 630V replacement. Perhaps the capacitor was faulty but it sure did burn out. Correction: it blew out – pow!

If you don't have a signal generator, then there is little point in using an output meter in the manner described above. When using radio stations as a signal source, an output meter will flicker up and down according to the instantaneous level of the voice or music signal being received.

On the other hand, if using a signal generator, the meter needle will remain steady because the audio signal is constant. Under these conditions, it is very easy to align a receiver for maximum needle deflection on an output meter.

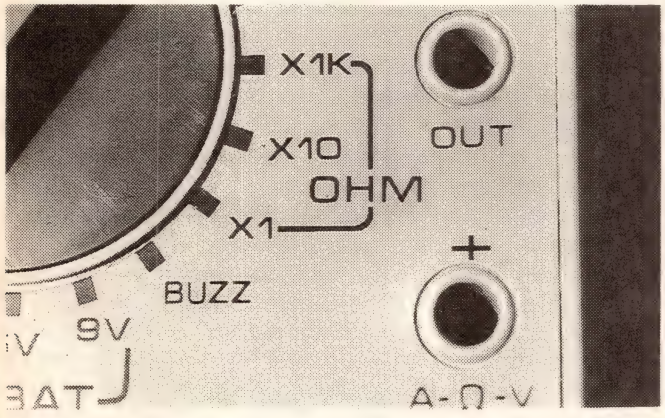
Alignment tools

The tools used for alignment adjustments are confined (in most instances) to insulated screwdriver blades. However, the everyday screwdriver is not the best tool to use. Simply touching a metallic screwdriver blade onto some alignment components will change the alignment. And in some cases, it can cause a high tension short circuit or give the operator an electric shock.

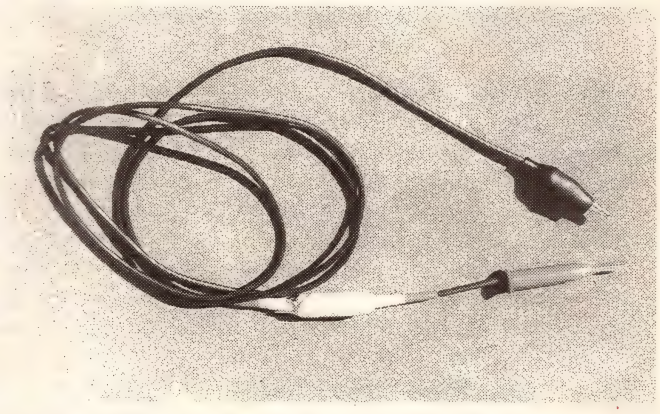
The recommended tool in the old days was a non-metallic screwdriver fashioned from a toothbrush handle or similar insulating material. Such a tool is quite satisfactory provided it will turn the adjustment screw.

Unfortunately, plastic screwdriver blades are a bit gutless when it comes to torsional strength. If the adjustment screw shows any degree of resistance, then the blade simply snaps off. In addition, many modern insulated alignment tools are moulded from a flexible plastic material which is often inadequate for valve radio applications.

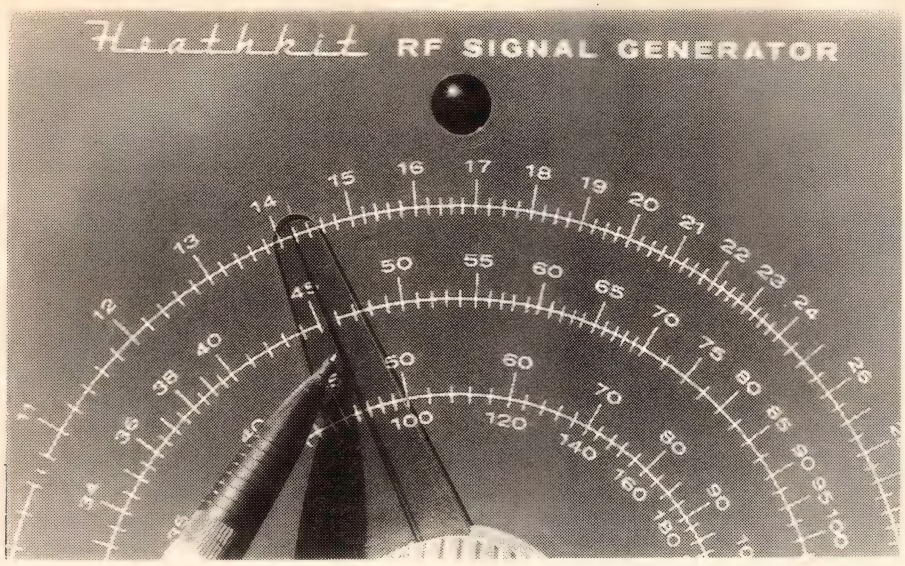
I recently made a couple of alignment tools from 6mm-diameter acrylic rod. Into the ends of these rods are cemented very short metal screwdriver blades which have been spe-



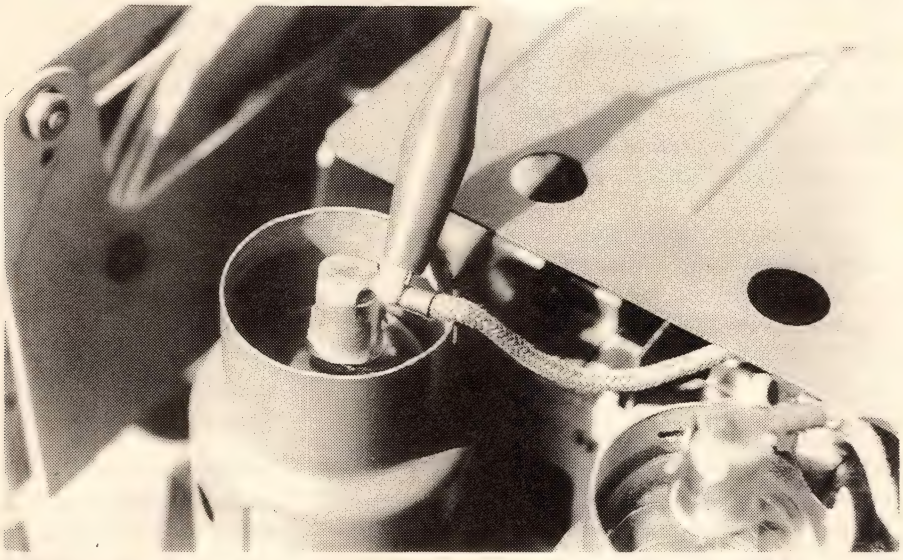
This multimeter has an output socket with a high-voltage capacitor in series with the meter circuit to block any DC components. It can thus be used to monitor the output signal level by connecting it directly to the anode of the output valve. Not all multimeters have this function.



An AC voltmeter can be used as an output meter simply by fitting a .047µF 400V capacitor in series with one of its test leads. The capacitor blocks the DC voltage on the anode of the output valve but allows AC signal voltages to register on the meter.



455kHz is by far the most common IF for valve radios. However, many early superhets had odd frequencies, with 175kHz being quite common in the 1930s.



When aligning the IF transformers on a superhet, the generator signal is injected into the circuit via the grid of the frequency converter valve. If the valve does not have a top cap, a connection on the appropriate fixed plates of the tuning gang will do the job just as well (see text).

cially made in various sizes from high carbon steel. These alignment tools give the best of both worlds in that they are reasonably strong and the small metal tip has little or no affect on the alignment setting.

In some cases, however, the alignment components are so stiff that they can only be turned with a standard screwdriver. This is of no great concern provided the tool is used properly.

First, the blade needs to be fully insulated to within one millimetre of the tip, to prevent short circuits and possible electric shock. This can be done using insulation tape or a piece of heatshrink tubing of appropriate size and length.

Second, after each adjustment, the metal screwdriver must be removed from the screw slot so that the output meter can display the true reading. Alignment may be a bit slow and tedious by this method but sometimes there is no alternative. If the adjustment screws are tight, then a metal blade is the only way to move them.

Alignment procedure

The correct starting point for superhet alignment is at the intermediate frequency (IF) transformers. The first step is to connect the RF generator leads to the grid of the frequency converter valve and to chassis.

If you have trouble working out where the grid is on the converter valve, it is usually the top cap that connects to one of the tuning capacitor gangs. If the valve has no top cap grid connection, trace the wiring to determine which tuning gang section connects directly to the converter valve and connect the generator lead to the fixed plates of that particular section (or to the corresponding valve socket connection).

It is important to inject the correct frequency into the receiver in order to tweak up the IF transformers. Today, the industry standard IF is 455kHz and this frequency has been established long enough for it to apply to many valve receivers as well. However, some early superhets had quite weird IFs, as a quick look at Table 1 will show. The set's IF transformers should be tuned to the frequency that they were supposed to operate on but this frequency is not always known.

Now if a receiver with a 460kHz IF is aligned to 455kHz, it will not prevent the receiver from working – although it will work better when aligned to the correct frequency. In particular, it may upset the dial calibrations slightly and/or the front-end tracking. More on this later.

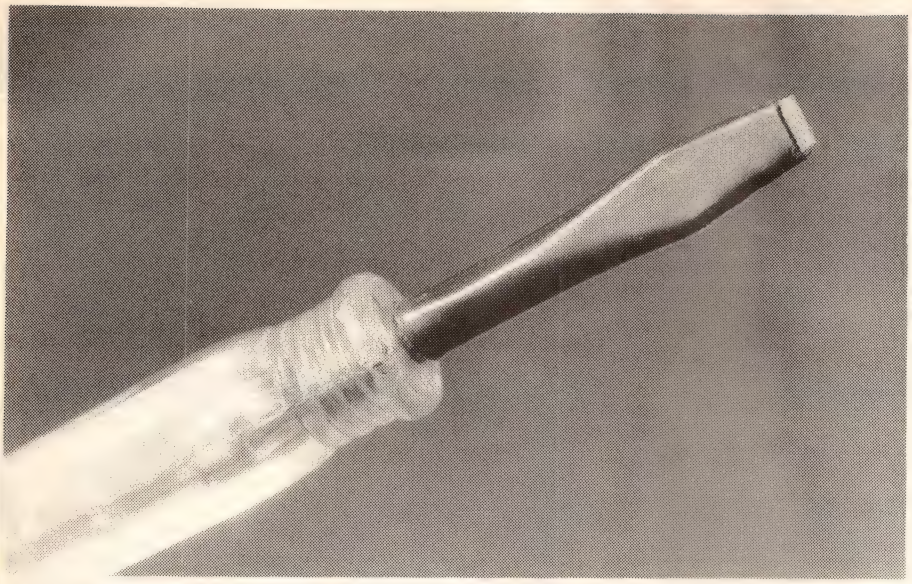
One way to ascertain an unknown IF is to connect the signal generator to the receiver and adjust the generator dial until maximum signal is heard in the loudspeaker. Provided that the IF transformers have not been previously tampered with, the generator dial should indicate the receiver's IF.

Once the IF has been established, the IF transformers can be adjusted

TABLE 1

Variations in intermediate frequencies as taken from the 1938 Australian Radio Service Manual

kHz	kHz	kHz
175	392	458
180	450	468
182	452.5	462.5
250	455	465
252	456	470
252.5	457.5	472



A metal-bladed screwdriver can be used as an alignment tool when the adjustment screws are tight. This particular tool has an insulated blade with only the tip exposed. Such a precaution is necessary when adjusting early IF transformers to prevent short circuits and possible electric shocks.

for maximum output. This should be done with the tuner plates completely out of mesh, the volume control at maximum and the signal generator adjusted to feed in just enough signal to activate the output meter.

AVC action

There is a very good reason for these level settings and that is to effectively disable the AVC (automatic volume control) system. If the AVC is operating, it will try to counteract any increase in output signal due to improved alignment, thereby making the improvement less obvious. Since most AVC systems are (level) delayed, keeping the input level down renders them inoperative. As sensitivity increases with alignment, the input level from the generator should be progressively decreased, to keep the output approximately constant.

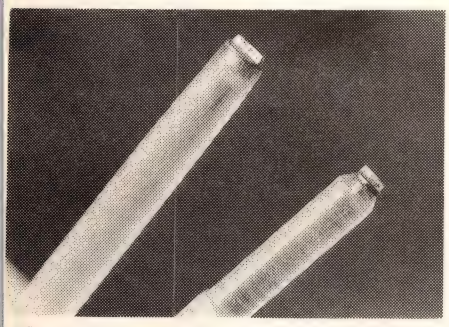
If an off-air signal must be used, there is another way to set up an output meter, this time so that it monitors the AVC system. By using a stronger (off-air) signal, the AVC system will be activated and, by monitoring this, we can measure the effect of adjustments.

The AVC action can be monitored by measuring the voltage developed across the cathode bias resistor of the IF amplifier (typically 3V). As alignment progresses, more AVC voltage is applied to the valve grid, less current is drawn, and less cathode bias is generated. So you simply adjust the IF transformers for a dip in the meter reading, rather than a peak.

Note, however, that the meter may not respond to adjustments to the IF secondary winding. The AVC voltage is normally taken from the primary of this transformer. But all earlier stages (aerial, RF, oscillator and IF primary) can be monitored.

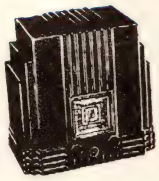
When making these adjustments, it matters little in what order they are done provided that the trimmers or cores are peaked a number of times. Some adjustments will be sharper than others.

At this stage the IF transformers are aligned. The next step is to align the aerial and oscillator circuits. This will be covered in next month's Vintage Radio. **SC**



These two special alignment tools were made using acrylic rod and metal screwdriver tips. The small steel tips were cemented into the ends of the rods.

RESURRECTION RADIO



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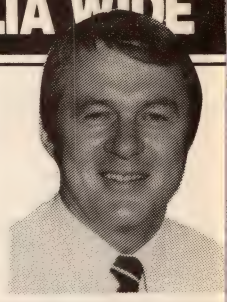

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(EA Feb '92)

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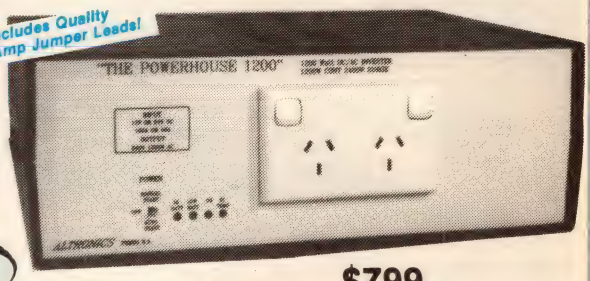

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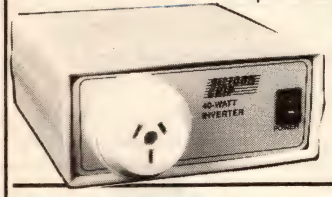

This fantastic little unit is ideal for use with incandescent globes, (note this model inverter will not run fluorescent lighting) electric shavers, small radios and some plug pack operated devices, ie charging cordless drills and other rechargeable battery appliances etc.

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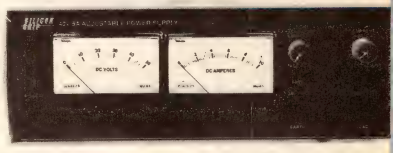
Massive Power Capabili

Using state of the art circuitry this supply will be a great asset to the enthusiast and professional alike. It uses switch mode principles which allows for smaller transformers, and heatsinking which means greater efficiency, less heat and lighter weight.



Features: • Variable output • Variable current limit • Separate Earth Terminal • Individual Volt and Amp Meters • Constant 13.8V setting • Short circuit proof

Specifications: • Output voltage 0-45V • Output current 8A @ 35V, 6A @ 40V • Load regulation 1% • Ripple and Noise 40mVp-p at 8A 35V • Current limit 800m 8.6A • Over current limit 9A • Foldback current less than 2A

Video to TV Transmitter

Watch the Video from any Room in the House! No Wires

(SC Dec '91)

This TV transmitter enables you to transmit signals from the output of your VCR to a second TV set in the house without messy splitters and cables. Two versions available for videos with UHF or VHF outputs.

K 5860 UHF Version
K 5865 VHF Version **$74.95**

NEW FOR '92

Baby Room Monitor

(S.C. Jan '91)

K 1180 **$24.95**

NEW FOR '92

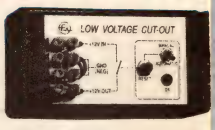
This Baby Room Monitor allows you to listen to your baby from a remote location using a conventional FM receiver. It runs from a single 1.5V AA battery and includes a muting facility so that it only transmits sounds above a certain level.

Low Voltage Cut-Out for Cars and Boats

(SC Jan '92)

NEW FOR '92

Build this simple little device, and avoid getting caught out with a flat battery during your holidays. It simply connects into a 12V accessories power line, and shuts off the flow if the battery voltage drops to a dangerously low level. Ideal for battery powered camping fridges etc. Adjustable Cutout Variable from 10.9V to 11.9V. Includes Automatic or Manual Voltage Reset Function.



K 4328 **$24.95**

Digital Altimeter for Gliders and Ultralights

(SC Sep/Oct '91)

This compact digital altimeter can display altitude up to 19,990 feet with 10 feet resolution. Accurate to better than 3.5 percent. A must for hang-gliders, ultralights etc. Operates on 9V battery.

K 2580 **$299.00**

NEW FOR '92

Infra-Red Light Beam Relay

(SC Dec '91)

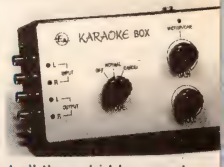
This simple project allows you to monitor a doorway or a path using an infrared light beam. When someone walks through the beam, it triggers an alarm for a 1 second period. Ideal door monitor for shops or for security around home or office. Requires 12V DC plugback (M 9002).

K 1920 **$32.95**

NEW FOR '92

Low Cost 'Karaoke' Adaptor

(EA Nov '91)



It's time to bring out all those hidden vocal talents that you've always known were there. W this project you can remove the lead vocal from almost any recording, and replace it with your own via a standard microphone. It's a great way to liven up a party!

K 1170 **$34.95**

NEW FOR '92

240V Power Relay

(EA Jan '92)

Here's a simple project that monitors the power drawn from a 'master' socket and automatically switches on a 'slave' socket. It is versatile, because it can monitor one or several appliances plugged into the 'master' and switch on one or several devices plugged into the 'slave'. Ideal for Hi-Fi's or computers with peripheral hardware.

K 6070 **$59.95**

Activate all Your Hi-Fi by Turning on just the Amplifier!

4 Channel Guitar Mixer and Preamp

NEW FOR '92

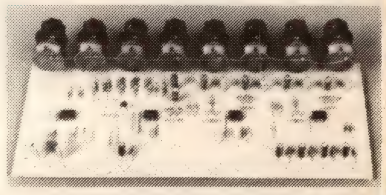
(SC Jan 1992)

K 5535 **$49.95**

This unit features separate bass, midrange and treble controls, very low noise and distortion, separate input level controls plus an output level control. Ideal for use with most musical instruments from keyboards to guitars to tape decks. In fact, you can feed it with just about any audio signal — it's not just limited to guitar outputs.

- **Distortion:** (at 1kHz and 100mV input) less than 0.0075%
- **Frequency Response:** 18Hz-35kHz (+/-3dB).

The kit includes PC Board, potentiometres, input sockets and all specified components. The kit does not include the optional ground plane, nor the 15V power supply board.



PHONE ORDER TOLL FREE 008 999 007

JET EXPRESS DELIVERY· AUSTRALIA WIDE

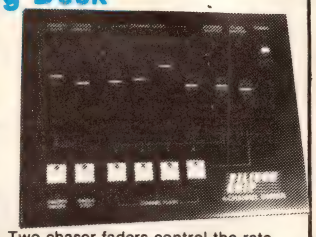
ALTRONIC COMPONENTS

New 4-Channel Lighting Desk

SC June/July '91)

ake your stage production a professional ow with this new Lighting Mixer. Ideal for nateur theatre groups bands etc.

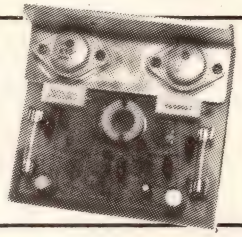
his 4-channel lighting desk is intended for eatre, disco and music group applications. has heavy duty circuitry and is able to cope ith spotlights rated up to 1000 watts or ore. It has been designed and built for the gours of commercial use. You can flash ch channel up to any brightness as set by e 'Flash Master' fader. Similarly, the hannel Master' control fades all lights up or wn, to or from their individual fade settings. Two chaser faders control the rate d lamp brilliance when the unit is operated in chaser mode. The lights can be shed to full brilliance or to an intermediate setting as set by the 'Chaser Master' der.



K 5815 **$329.00**

0W Mosfet Module

) Watts RMS into 8 Ohms. This great module atures moderate power output at low armonic distortion. Simple to build and mpact in size this unit makes a great placement module for your old Hi-Fi or buy vo and make your own stereo amplfier.



5115 **$49.95**

Stereo 50 + 50 Watt Midi-Style Amplifier

Replace That Old Beaten Up Amp!

SC Feb and March '92)

This fantastic new amp has all the features of commercial units costing hundreds of dollars more using tip 142/147 transistors it is capable of producing a total of 50 Watts per channel RMS. Into 8 Ohms makes an ideal replacement midi unit.

Performance:
Output Power: 55W into 8 Ohms, 80 watts into 4 Ohms
Harmonic distortion: less than 20Hz to 20kHz

5045 **$299.00**

New High-Tech Remote Car Alarm

This amazing new model features just about everything you could imagine! Multifunction keyring remote control will arm and disarm alarm (and activate central locking if fitted), chirp the horn, turn on car headlights, panic and even open the boot (if actuator fitted). One remote can control two alarms. Other features include: Starter inhibit, valet mode, central locking interface, flashes car indicators when tripped, auto reset plus much more!

S 5230 **$249.00**
S 5231 Replacement Remote Control **$48.50**

DIRECT IMPORT PRICE

2 Way Active Crossover

(E.A. Jan '92)

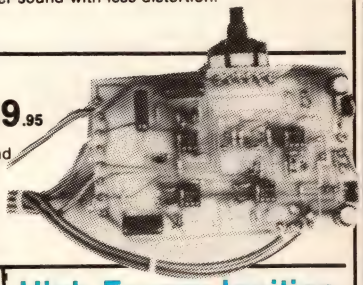
This great new kit enables you to customize your sound system in your car or at home. The circuit simply connects between the audio source and the amplifiers. There are two outputs, one for bass and another provides signal for the upper range. Thus each amp is dedicated to a frequency range (i.e. one for bass, one for midrange and treble). Because no passive crossover is required in the speaker one per channel is required. Operates on + and -15V rails. The result is much better sound with less distortion.

K 5570 **$19.95**

Surround Sound Decoder

K 5585 **$39.95**

(E.A. Jan '92)



Build this new surround sound processor and envelope yourself with the stunning realism and dramatic sound impact available from surround-encoded videos or TV transmissions. It can also enhance conventional stereo, by providing a rear or 'ambiance' channel.

0-30V Power Supply

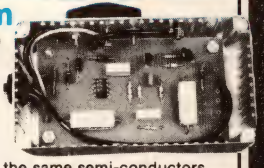
(EA Jan '85)

K 3210 **$109.00**

Features:
• Variable Output • Short Circuit Protected • Full 1 Amp Available • Variable Current Limit • Separate Earth Terminals • Dual Scale Meter • 3-30V to 1 Amp Max with Variable Current Limit • Output Current: 0 to 1 amp • Load Regulation: 0.2% Max • Output Ripple: 2mV RMS Max.

High Energy Ignition System

(SC May '88)



This "state of the art" electronic ignition system uses the same semi-conductors as found in modern motor cars. Extends the life of plugs and points. Increases power and improves fuel economy. Compatible for 4, 6 and 8 cylinder engines. Install one into your car and start saving $$$ from the very first day.

K 4015 **$58.50**

Economy Alarm Panel

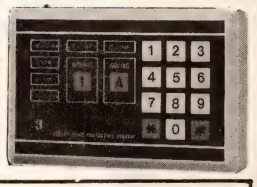
For Homes and Small Commercial Premises

This is a 3 zone alarm control panel designed for the protection of homes and small commercial premises. It employs the latest advanced electronic circuitry offering the highest degree of quality and reliability. It will accept either active or passive normally open or normally closed sensors making it both a versatile and effective protection system. 12V battery charger inbuilt. See Altronics '92 catalogue for full details.

S 5480 **$139.00**

Flush/Surface Mount Alarm Panel

With stylish compact good looks this alarm blends smoothly into any residential or office decor by either flush mounting into the wall, or surface mount. 3 sectors include 24 hour panic/fire, perimeter and internal which can be isolated enabling the alarm to be armed at night with occupants inside whilst still protecting entries. simple 4 digit access code for operation. See Altronics '92 catalogue for full details.



S 5490 **$119.00**

UHF Microprocessor Controlled Wireless Security System

Apart from the flawless operation of the system one of the great features is its application with rented or leased premises — let's face it, money spent on installing a wired system in your home or office, factory, etc is irrevocably lost when you move on. With this system you simply take it with you. Ultra high-tech and push button operation makes this unit a breeze to install and operate. Features 6 sectors plus 2 x 24 hour fire and tamper circuits. The **S 5240** system includes main controller, 1 Passive Infra Red Movement Detector, 1 window or door Reed switch, wired siren, power supply, back-up rechargeable battery, and a special personal remote. All sensors are radio transmitters which means no wiring is neccessary (except for the plug pack and siren). The whole system is coded so it can not be interfered with and can be changed any time by the owner. Each individual sensor can be easily set to operate on any sector. The main controller utilizes latest EEPROM technology which means things like selecting user on/off codes, isolating sectors are a breeze. Includes a myriad of other amazing features, too many to mention.

Call ALTRONICS today for a free colour brouchure.

Complete system includes:

1 x Control Panel
1 x Passive Infra Red Detector/Transmitter
1 x Door/Window reed Switch/Transmitter
1 x Hand Held remote Control/Transmitter
1 x Horn Speaker — 10 watt/wired
1 x 240V AC adaptor
1 x 1.2Ah Back-up Battery
1 x Set of batteries for all transmitters

S 5240 Complete System

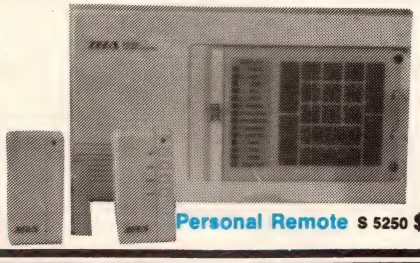
Only **$679.00**

External Siren

C 2015 **$15.95**

Door/Window Reed Switch & Transmitter

S 5247 **$72.95**



Personal Remote S 5250 **$62.95**

Wireless Remote Keypad

S 5255 **$135.00**

Passive Infra Red Movement Detector

S 5245 **$155.00**

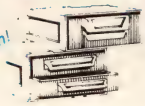
PHONE ORDER TOLL FREE 008 999 007

ALTRONIC COMPONENTS

JET EXPRESS DELIVERY• AUSTRALIA WIDE

Interlocking Parts Drawers

Sort Out that Work Bench!



Unique design allows units to be 'dove-tailed' together. Drawers will not stick or seize. Single or double drawers available.

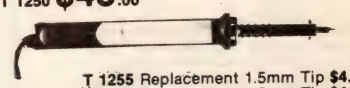
H 0235 Single **$4.95 ea**

H 0236 Double **$5.50 ea**

De-Soldering Iron

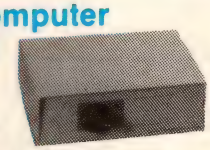
This lightweight de-soldering iron allows components to be quickly and cleanly removed with one hand. Naturally it's SEC approved and comes with a cleaning wand. Can be used as a soldering iron. 240VAC 30W. Earthed. Simple cleaning action.

T 1250 $45.00



T 1255 Replacement 1.5mm Tip **$4.95**
T 1252 Replacement 1.2mm Tip **$4.95**

A/B Computer Switch Box



Two way printer/peripheral computer switch with D25 sockets. Allows two printers to be run off one computer and individually selected or allows one printer to be run off two computers and individually selected.

D 1570 Normally ~~$49~~.95 *NEW FOR '92*

This Month **$39.95**

Temperature Adjustable Soldering Iron

Screwdriver temperature adjustable between 250°C and 450°C enabling very delicate soldering on low settings with surprising heat energy reserve on maximum setting. Relative temperature is indicated by LED lamp brightness. **Now uses state of the art ceramic heating element.**

T 2446 Normally ~~$49~~.95

This Month **$39.95**

All New IRODA Gas Soldering Iron

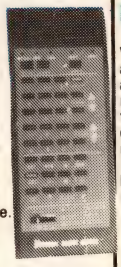
T 2450 $39.50

Winner of the Taiwan Good Design Award
Now you can solder anywhere with this new gas soldering iron.
Features • See through gas chamber (no more guessing how much gas is left!) • Built in ignition cap • Uses standard butane gas • Comes with safety bench stand • Supplied with 2mm soldering tip and blow torch tip • Adjustable temperature from 400°C to 1200°C • Can be easily refilled with standard butane lighter gas • Replacement tips are less than half price of some other brands!

REPLACEMENT TIPS - ALL $4.95 ea

T 2451 Replacement 1mm Conical Tip
T 2452 Replacement 2mm Conical Tip
T 2453 Replacement 3mm Conical Tip
T 2454 Replacement 3mm Chisel Tip
T 2455 Replacement Exhaust Port
T 2456 Hot Knife Tip
T 2457 Hot Blower Tip
T 2458 Blow Torch Tip
T 2448 Weller Butane Gas Refill **$5.95**

Universal Remote Control



This universal infra-red remote control makes all other remote units superfluous. Will control CD players, videos, TV's and stereos etc. Controls up to 6 different appliances. Easy to use and programme from an existing functional remote.

A 1000 $69.95

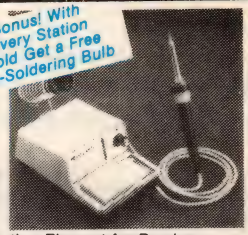
Scoop Purchase On Door Alarms

With this simple device you can monitor any door in your house. This two piece alarm consists of control box and magnet. The magnet simply mounts onto the door frame while the unit is mounted on the door so that when closed, the magnet and control box are opposite. Easy to use on/off switch. Built in beeping buzzer sounds when tripped. Requires 9V battery.

S 5315 $15 AMAZING PRICE!

Micron Mk II Soldering Station

Bonus! With Every Station Sold Get a Free De-Soldering Bulb



Electronic Temperature Controlled, Temperature Selectable, Soldering Station. The MICRON T 2440 soldering station offers the ultimate in controlled temperature hand soldering.

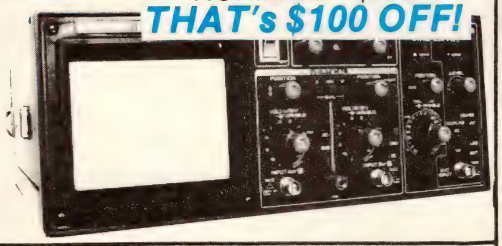
Features: • Variable Temperature Control • LED Temperature Readout • Zero Voltage Switching protects CMOS Devices • Grounded Tip • 48 Watt Element • Thermocouple Imbedded in Heating Element for Precise Temperature Control • 24V Low Voltage Element • Rubber Silicon Lead • Chrome Plated, Iron Clad Ultra Long Life Tips • New Improved Ceramic Element

T 2440 Normally ~~$159~~.95, This Month Only **$139.95**

This is the 1992 model of our fantastic Labtech Dual Trace 20 Meg Scope. There are over 3000 now in service throughout Australia — Our customers include Universities, Research Establishments and Industry

Famous Labtech 20MHz Dual Trace Oscilloscope

SENSATIONAL VALUE
NORMALLY $699
THAT's $100 OFF!

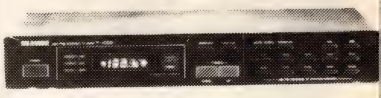


The '92 model is a dual trace 20MHz oscilloscope using a high brightness CRT. The vertical amplifiers have high sensitivity of 5mV/div and a frequency characteristic response with smooth roll off exceeding 20MHz. The TV sync. signal operator circuit is provided to ensure stable observation of video signals. Triggering is obtained by sampling the AC power waveform, external waveform or internally generated trigger. **Highly recommended for Service Workbench, Design Laboratory, Manufacturers, Universities and the dedicated enthusiastic.**

Q 0156 This Month Only **$599.00**

AM/FM PLL Tuner

Replace that old Dial Tuner!



This fantastic tuner is the ideal add-on to any sound system. Can be used as background music source in restaurants, shops etc or any PA application. Also a great upgrade for the home HI-FI.

Features:
- Digital LED frequency readout display
- FET FM front end for high image rejection
- Phase-linear ceramic filters are incorporated in both AM and FM IF section
- Phase-lock loop (PLL) IC for FM multiplex stage
- Dimensions: (W x H x D) 435 x 60 x 232mm
- Weight: 3kgs.

A 2210 Normally ~~$229~~.00,

This Month **$199.00**

Cro Probes

Ideally suited to Q 0156 (2 required). Superb quality. DC to 80 MHz. Max 600 Volts DC. Lead length approx 1.5m.

Q 0175 $49.95 ea

Illuminated SPST Rocker Switches

Amazing value! 240V AC inbuilt neon glows red. Panel cutout 18.6 x 13mm.

S 3218 $1.50 ea, or 10up $1 ea

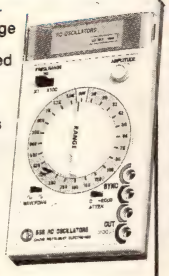
300 Watt Inverter

Amazing Low Price!

M 8120
$249.00

TURN 12V DC TO 240V AC.
This fantastic inverter will power lights, TV's, tools, electric shavers and a whole host of other appliances. Great for camping, out in the bush and any place where 240V is not available.
Features: • Complete with over current circuit breaker • Fused 240V output • Built in panel meter to monitor output voltage • Strong steel case and chassis.

Pocket Sized, Signal Generator

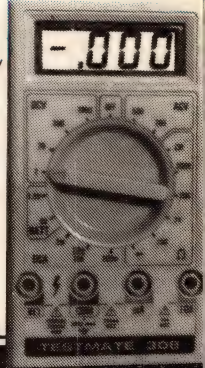


This pocket sized oscillator has all the features of a large bench oscillator. 46 preset switched frequencies ranged from 20Hz to 150kHz, eg: 1kHz, 1.2kHz, 1.5kHz, 1.8kHz, 2kHz etc. Smaller than most multimeters, this is ideal for technicians, servicemen, students and hobbyists who require an accurate and reliable oscillator ready to use anywhere

Q 1542 Normally ~~$99~~.00

This Month Only **$80.00**

Our Top Selling 17 Range Digital Multimeter for an Amazing $39.95



With quality and features you would expect only on expensive meters the Q 1056 represents excellent value for money.

Specifications:
DC Voltage: Ranges 2-2000V
AC Voltage: Ranges 200V, 500V
DC Current: Ranges 200mA, to 10A
Resistance: 5 Ranges 200 Ohm, to 2M Ohm
Diode Test: Test Current 1.0mA
Test Voltage 3.2V Max
Battery Test: Ranges 1.5V, 9V
Loaded Current: 1.5V 100mA, 9V 6mA

Q 1056 Normally ~~$49~~.95

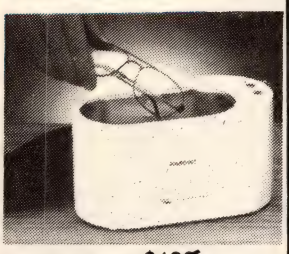
This Month **$39.95**
Q 1057 Carry Case to Suit **$12.50**

PHONE ORDER TOLL FREE 008 999 007

JET EXPRESS DELIVERY• AUSTRALIA WIDE

ALTRONIC COMPONENTS

Pin Point Ultrasonic Cleaner



Awarded the Good Product Design Award for CETDC in 1987. This fantastic Ultrasonic Cleaner can earn its cost a hundred times over in cleaning Computer Connectors, PCB's, Switches, Relays, Jewellery, Glasses, Watches etc.

A 0100 Normally ~~$195~~.00
This Month Only **$175.00**

12V DC Computer Fan

New model just arrived! 80 x 80 x 25mm. Ideal for amps, power supplies, computers and just about anything else that requires effective cooling. Exceptional value for money.

F 1050 $17.50

High Performance Crossovers

These models consist of only high quality components. PCB mounted quick connectors for easy and reliable wire connection.

2 Way, 80 Watts RMS
Crossover Frequency: 3.5kHz
dB/Octave: 6dB

C 4005 $11.95

2 Way, 150 Watts RMS
Crossover Frequency: 3.5kHz
dB/Octave: 12dB

C 4007 $26.95

3 Way, 80 Watts RMS
Crossover Frequency: 600-800Hz/5kHz
dB/Octave: 6dB

C 4006 $20.95

3 Way, 150 Watts RMS
Crossover Frequency: 600-800Hz/5kHz
dB/Octave: 12dB

C 4008 $49.95

Altronics Aviation Headset

Why Pay $400 or More??

• High performance noise attenuating earphones • Noise cancelling microphone • Cushioned head pad • Super sturdy • Great performance • Superb, professional pilot's headset will last a lifetime with reasonable treatment • Includes standard aircraft jacks.

Fantastic new model includes improved microphone and shielded cable, allowing even better performance! Now better value for many than before. Over 2000 already sold Australia wide.

C 9070 $189.00

Stereo Headphones with Dynamic Mic

Simply brilliant Mylar stereo headsets and dynamic mic combination.
Speaker Specifications: 20Hz-20,000Hz, 32 Ohm, 3.5mm stereo jack, 6.35mm stereo jack adaptor.
Microphone Specs: Dynamic type, 300 Ohm, 100 Hz-15,000Hz -80db @ 1 Khz, 3.5mm Mono Jack

C 9055 $44.95

Entertainers Cardioid Microphone

Professional Performance and Appearance. Balanced mic with unbalanced canon to 6.5mm lead. Includes vinyl carry case and mic holder.
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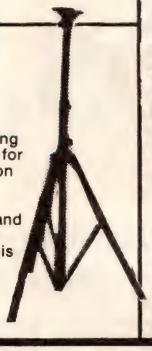

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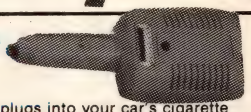

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P 3120	DB15 Male 90° PCB connector	$2.50	$2.25	$2.00
P 3130	DB15 Female 90° PCB connector	$2.50	$2.25	$2.00
P 3140	DB15 Male straight PCB connector	$2.10	$1.90	$1.70
P 3150	DB15 Female straight PCB connector	$2.10	$1.90	$1.70
P 3190	DB15 Backshell Cover	$2.20	$2.00	$1.80
P 3200	DB25 Male solder connector	$1.95	$1.75	$1.60
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P 3220	DB25 Male 90° PCB connector	$2.95	$2.65	$2.40
P 3230	DB25 Female 90° PCB connector	$2.95	$2.65	$2.40
P 3240	DB25 Male straight PCB connector	$2.50	$2.25	$2.00
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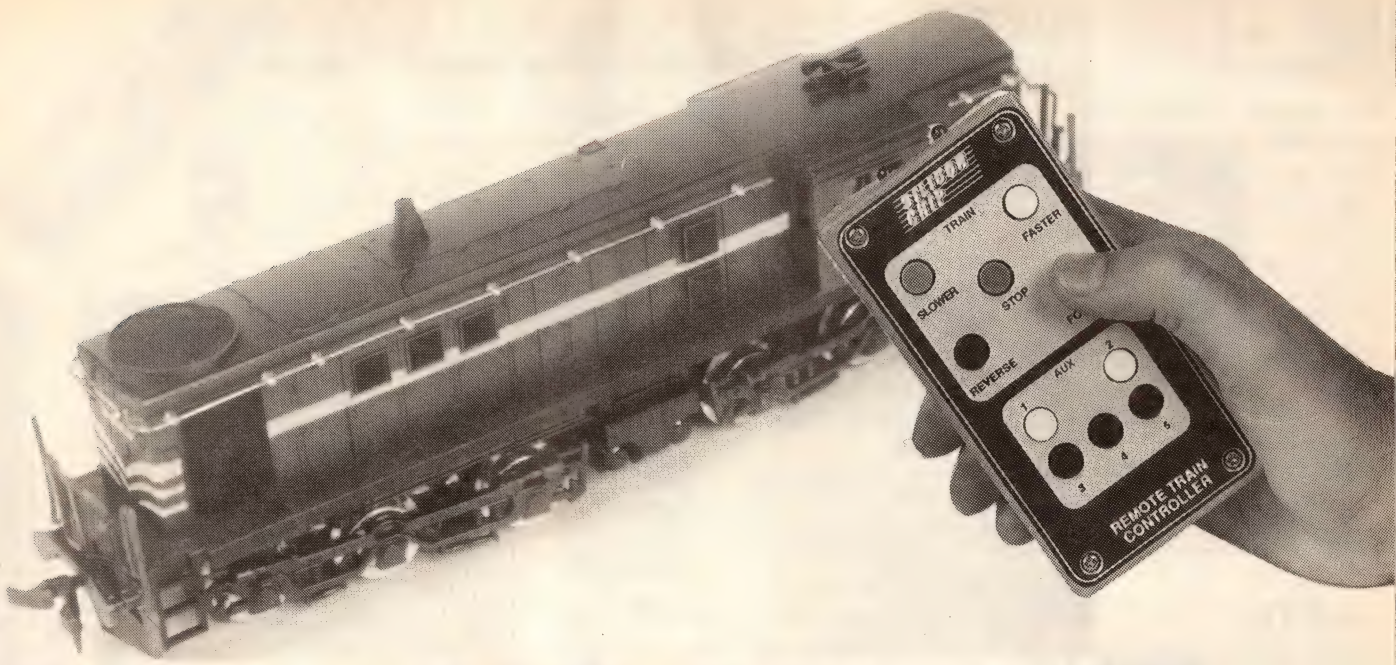


INFRARED REMOTE CONTROL FOR MODEL RAILROADS, PT.2

In this second article on our new remote control for model railroads, we present the circuitry for the remote control receiver. This mates up to the pulse power board described last month. It also provides latched and momentary outputs which can be used to control signalling, points and lighting on a model railway layout.

The receiver circuit comprises eight ICs plus quite a few transistors and diodes, as shown in Fig.7. IC5 and IC6 are the infrared remote control devices, while IC7, IC8, IC9, IC10a and IC11a provide the control signals for the pulse power circuit. Finally, IC10b, IC11b and IC12 are used for the various latched outputs.

IC5, a Plessey SL486 infrared preamplifier IC, is specifically designed for processing infrared control signals. This device features a differential photodiode input to reduce noise pickup and an automatic gain control circuit for improved operation in noisy environments. It also incorporates two gyrator circuits and these allow the device to receive signals in high ambient lighting conditions, such as from incandescent lamps.

The incoming IR signals from the remote control transmitter are picked up by photodiode IRD1 which is connected across the differential inputs of IC5. The received pulses are then amplified and filtered before they appear at pin 9. Capacitors connected to pins 2, 3, 5, 6 and 15 of IC1 roll off the frequency response of the gyrator and gain stages below about 2kHz. This effectively filters out any 100Hz signals produced by mains-powered lamps.

Automatic gain control is provided by an internal peak detector which measures the output signal appearing at pin 9. A 0.1µF capacitor at pin 8 filters the output of the peak detector and the resulting signal is used to

By LEO SIMPSON & JOHN CLARKE

control the gain of the first three amplifier stages.

Signal decoding

The signal from pin 9 of IC5 is directly connected to pin 1 of IC6, the decoder IC. This provides five BCD (A, B, C, D & E) outputs which can be either momentary or latched, depending on whether pin 5 is high or low. We have selected momentary operation by tying pin 5 high.

In addition to the five BCD outputs, IC6 provides a Data-bar signal which goes low whenever a valid code is present on the A, B, C, D & E outputs. This signal is used to drive the ACKnowledge LED (LED 6) via a 330Ω resistor. This LED therefore indicates whenever the remote control circuitry is receiving a valid signal from the transmitter.

Pins 3 and 4 are the A and B rate inputs and must be connected to match the transmitter rate input connections. When the links to these inputs are left open, internal resistors tie them high (ie, to +12V).

Three of the BCD outputs from IC6 are connected to IC7, a 4051 3-8 decoder (also known as an analog multiplexer). Depending on the BCD code presented to its inputs, IC7 pulls one of its eight outputs (pins 1, 2, 4, 5, 12, 13, 14 & 15) high. Actually, what really happens is that one of the eight pins is connected to the common pin (3) which is tied to +12V via a 2.2kΩ resistor.

The A, B and C inputs of IC7 are only decoded when the INHibit input (pin 6) is low. This input is connected to the Data-bar output of IC5 via a 10kΩ resistor so that decoding is done only when valid data (low output) is present on the A, B and C inputs.

Note that pin 6 of IC7 is also controlled by the D and E outputs of IC2 via diodes D15 and D16. Thus, when either the D or E output goes high, it inhibits IC7 and prevents any of its outputs from going high.

Logic level conversion

IC5 and IC6 operate between the +12V and +7V supply rails, while IC7 operates from +12V, +7V and 0V. The reason for this messy arrangement is because IC6 requires a 5V supply while the rest of the circuit needs to be compatible with the pulse power PC board which operates at 12V.

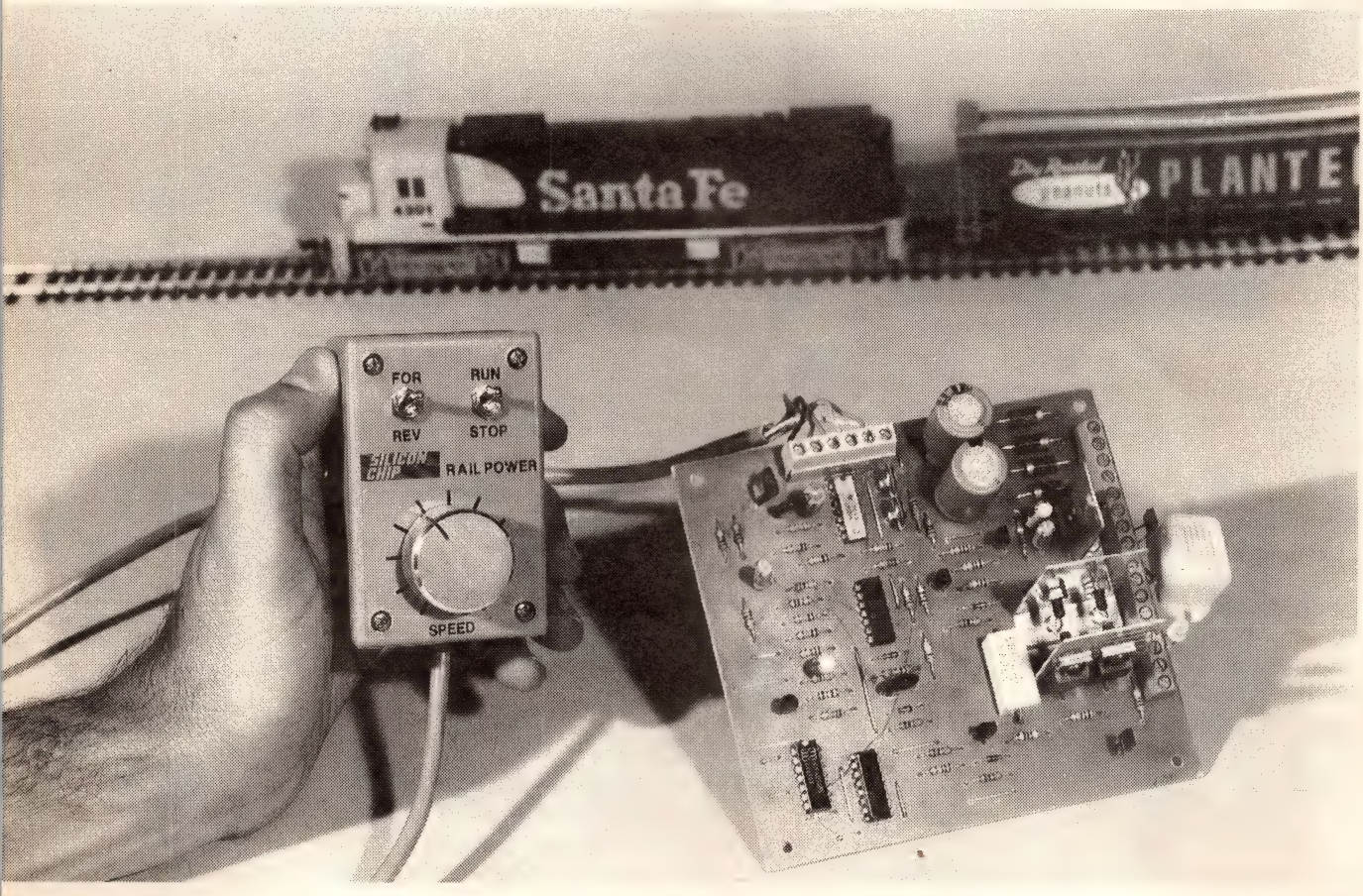
Thus, IC7 not only decodes the signals from IC6 but also provides logic level conversion so that its output signals swing between 0V and +12V.

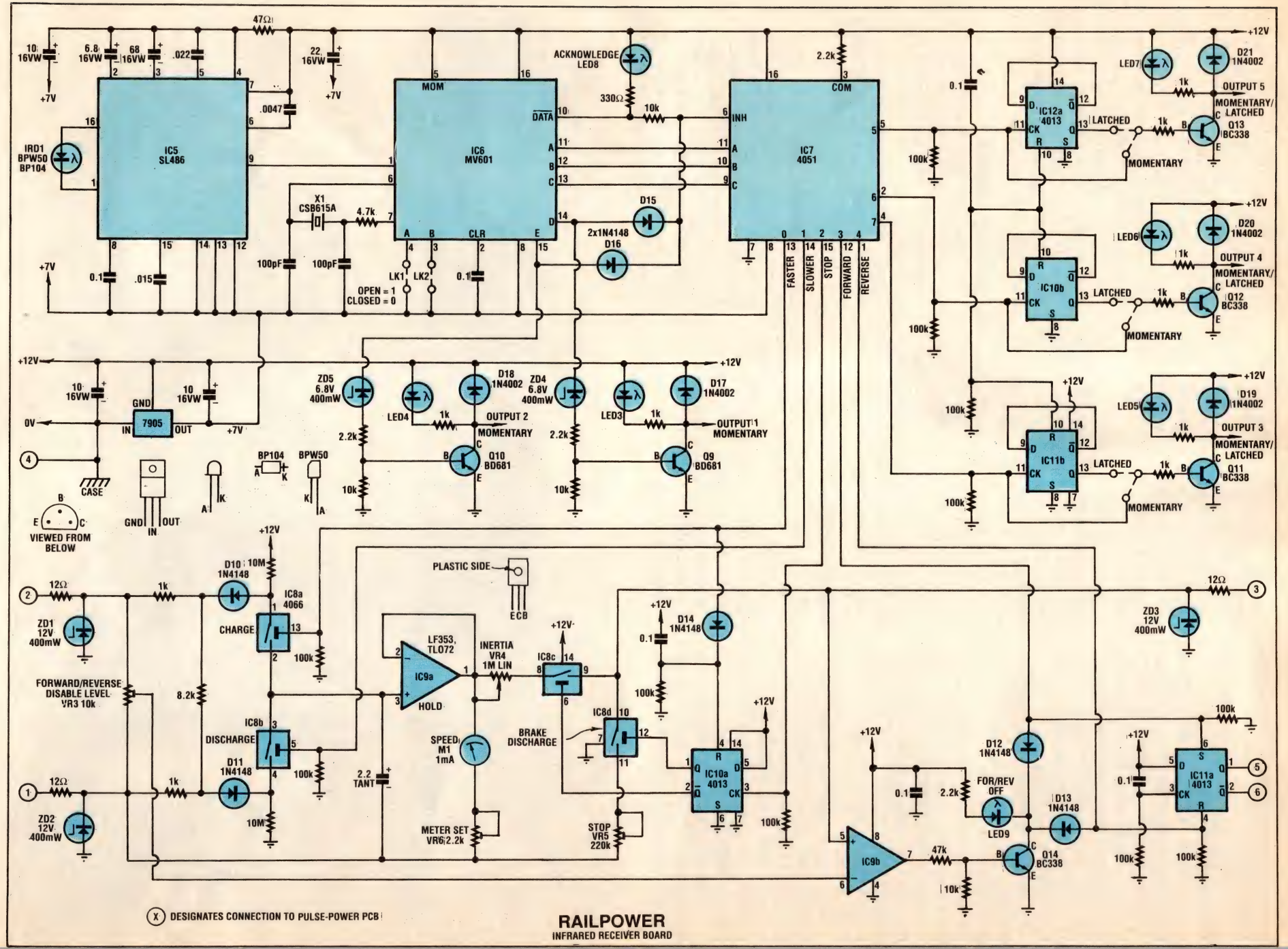
The +12V supply for the circuit is obtained from the +12V regulator on the pulse power PC board, while the +7V supply is derived from a separate -5V 7905 2-terminal regulator. This may seem a little unusual but the 7905 effectively operates as a current sink and subtracts its 5V from the 12V rail to give the +7V rail.

Auxiliary outputs

The five auxiliary control outputs are derived from the "5", "6" and "7" outputs of IC7 and the D and E outputs of IC6. The "5", "6" and "7" outputs of IC7 connect to the clock inputs of D-flipflops IC12a, IC10b & IC11b respectively. These are each

Shown below is the completed pulse power board, together with the hand-held controller that's used to test it. These two items are identical to the Railpower project published in the April 1988 issue of SILICON CHIP, which means that you can easily convert the original project to remote control.





RAILPOWER
INFRARED RECEIVER BOARD

Fig.7 (left): the receiver board decodes the signals from the infrared transmitter. IC5 (preamplifier) & IC6 (decoder) are the infrared remote control devices, while IC7, IC8, IC9, IC10a & IC11a provide the control signals for the pulse power circuit. IC10b, IC11b & IC12 are used to provide latched outputs for signalling, points switching & lighting.

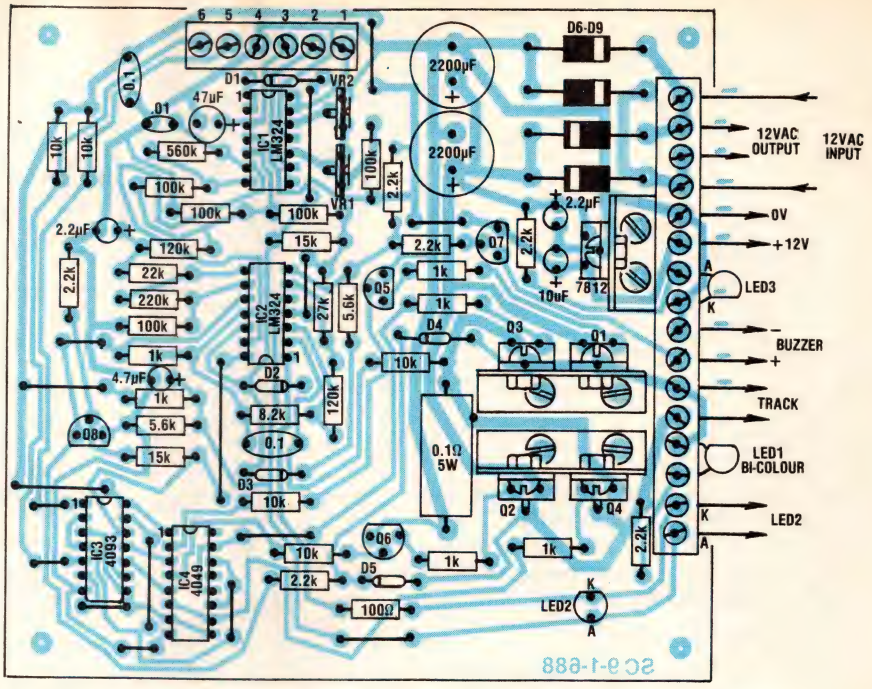


Fig.8: this is the parts placement diagram for the pulse power PC board. Note that IC2 is oriented differently to the other ICs & take care to ensure that the two heatsinks used for transistors Q1-Q4 do not touch each other. Trimpots VR1 & VR2 set the maximum and minimum track voltages & must be adjusted as described in the text.

connected with the D input tied to the Q-bar output so that each time their clock input goes high, the Q output changes state, from a low to a high or from a high to a low.

This provides the latched output facility so that the first press of a button on the transmitter latches the relevant output on and the next press latches it off.

The Reset inputs of these flipflops are all tied to an RC network consisting of a 0.1µF capacitor and 100kΩ resistor. This provides a power-on reset facility. At power-on, the 0.1µF capacitor is discharged and so the reset line is momentarily held high until the voltage drops to 0V via the 100kΩ resistor. This resets each flipflop so that its Q output is low.

The Q outputs of IC12a, IC10b and IC11b are connected to transistors Q13, Q12 and Q11 to provide the latched outputs. Alternatively, the flipflops can be bypassed, via a link option, for momentary operation.

Each of the three transistors can drive a 12V relay, connected between the collector output and the +12V supply. Each transistor has an associated diode to provide protection against any spike voltages that may be generated when a relay is switched off. Also associated with each transistor is a LED (LEDs 5, 6 & 7) which is lit when the output is on.

The D and E outputs of IC6 drive transistors Q10 and Q9, each via a 6.8V zener diode (ZD5 and ZD4) and a 2.2kΩ resistor. These provide momentary outputs only and, as with the other three outputs, have LEDs (LED4 and LED3) to indicate when they are on.

The 6.8V zener diodes are used because the D and E outputs of IC6 are at +7V when off (low) or +12V when on (high). When the outputs are at +7V, the zener diodes prevent the transistors from turning on. Note that Q9 and Q10 are high gain Darlington transistors which are needed due to the limited base drive available from the D and E outputs of IC6.

Train control

The remaining circuitry on the receiver board is used to provide the various throttle functions via the pulse power board. You will need to refer to the circuit diagram of the pulse power board published last month to be able to fully understand the circuit description to follow.

There are six connections from the receiver board to the pulse power board. Terminals 1 and 2 provide connections for the minimum and maximum speed setting voltages (from VR1, VR2, IC1a & IC1b on the pulse power board). Terminal 3 is the speed control voltage (fed to pin 3, IC1c on the pulse power board), while terminals 4, 5 and 6 provide the 0V connection and the forward/reverse control.

Each of the terminal 1, 2 and 3 points on the receiver board feature input protection for the CMOS circuitry. This takes the form of a 12Ω series resistor and 12V zener diode to ground (0V).

The "0" and "1" outputs of IC7 (pins 13 & 14) correspond to the "faster" and "slower" buttons on the remote control transmitter. They connect to the control inputs of CMOS analog switches IC8a and IC8b.

When pin 13 of IC7 goes high (corresponding to the "faster" button being pressed), switch IC8a closes and the 2.2µF capacitor at pin 3 of IC9a is charged via a 10MΩ resistor connected to the +12V rail. When pin 14 of IC7 goes high (when the "slower" button is pressed), switch IC8b closes and discharges the 2.2µF capacitor via the 10MΩ resistor connected to 0V.

The 2.2µF capacitor can charge no higher than the voltage at Terminal 2 and can discharge no lower than Terminal 1. This is achieved by clamping diodes D10 and D11 and the associated resistive voltage divider between Terminals 1 and 2.

The reason for using this fairly complicated capacitor charging, discharging and clamping arrangement is to give more linear charging and discharging and thus a better throttle response from the transmitter buttons.

Sample and hold

The voltage across the 2.2µF capacitor is buffered by FET-input op amp IC9a which acts as a sample and hold circuit. This is desirable because the capacitor voltage is the throttle setting; you don't want it changing after it has been set. Since the op amp

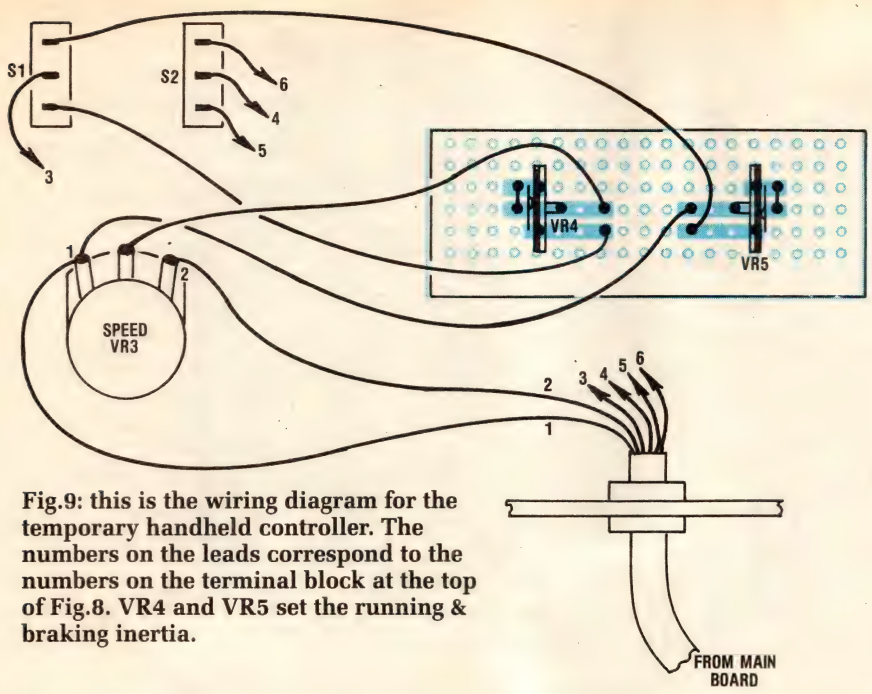
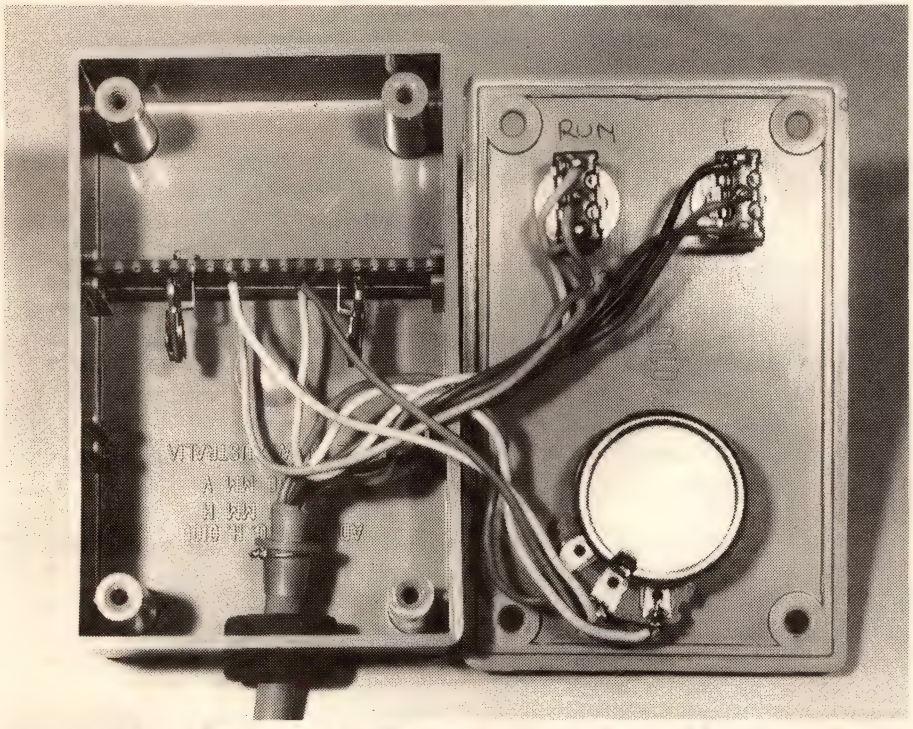


Fig.9: this is the wiring diagram for the temporary handheld controller. The numbers on the leads correspond to the numbers on the terminal block at the top of Fig.8. VR4 and VR5 set the running & braking inertia.



This view shows how everything fits together inside the hand-held control unit that's used to test the pulse power board. A 6-way telephone cable makes a handy connecting lead.

draws an extremely low current (typically 50 picoamps), the rate at which the capacitor discharges will be almost solely due to its own leakage current.

In practice, a typical 2.2µF tantalum capacitor should hold a voltage across it for five minutes or more before any noticeable reduction occurs.

The output of op amp IC9a is at the same voltage as the capacitor and is used to drive the speed setting meter via trimpot VR6. IC9a also drives inertia pot VR4. Normally, the following analog switch, IC8c, is closed and the run inertia pot connects to Terminal 3 of the pulse power board. This input has a 47µF capacitor which is charged via VR4 to set the train speed.

If VR4 is set for high resistance, the following 47µF capacitor on the pulse power board will take several minutes to charge to the throttle setting, thus simulating the inertia of a real train. Conversely, if VR4 is set for minimum resistance, there will no inertia, which might be desired for shunting manoeuvres.

Braking

IC10a, IC8d and VR5 control the braking. IC10a is a D-flipflop which is normally set with its Q output (pin 1) low and its Q-bar output (pin 2) high. The high on pin 2 closes switch IC8c for the normal run mode (ie, normal running, brake not applied).

When the stop output (pin 15) of IC7 goes high, flipflop IC10a changes state. Thus, pin 2 of IC10a goes low, causing analog switch IC8d to open. At the same time, pin 1 of IC10a goes high and closes analog switch IC8d to discharge the 47µF capacitor connected to Terminal 3 of the pulse power board via trimpot VR5. This is the braking mode. The degree of braking is set by adjusting VR5.

Hence, pushing the Stop button on the transmitter will cause the braking circuit to activate and it then stays that way until the Faster button is depressed (a momentary press is all that is required). When this happens, the "Faster" output of IC7, pin 13, goes high and pulls reset pin 4 of IC10a high via diode D14. This resets IC10a's Q output to low and the Q-bar output high. Switch IC8d now opens and switch IC8c closes to revert to normal running.

Forward/Reverse

Forward/reverse control is provided with flipflop IC11a. This is initially set at power-on with its Q output (pin 1) high and the Q-bar output (pin 2) low. These outputs are connected to Terminals 5 and 6 and thence to the pulse power board. Thus, when power is first applied, the circuit is set in the forward mode.

When the Reverse output – pin 1 of IC7 – goes high, it pulls pin 4 of IC11a high to reset it. This causes the Q output to go low and the Q-bar output to go high. This is the reverse mode.

Forward/reverse lockout

However, there is more to the forward/reverse control than this. IC9b is an op amp connected as a comparator. It compares the voltage at Termi-

nal 3 with the voltage set by VR3.

In practice, VR3 is adjusted so that the output of IC9b goes low only when the voltage at Terminal 3 is so low that the train is either running very slowly or has completely stopped. If the voltage at Terminal 3 is higher than the setting of VR3, IC9b's output will be high; this is the normal condition while the train is running.

The high output from IC9b turns on transistor Q14 and thereby pulls both the set and reset of IC11a low via diodes D12 and D13. This prevents IC11a from changing state and so prevents a change in direction; ie, gives forward/reverse lockout unless the loco speed is zero or very low. This condition causes the For/Rev Off indicator, LED 9, to light.

If the For/Rev Off indicator is alight, you cannot change the direction of the loco.

Construction

We now come to the construction procedure for the pulse power controller. It is housed in a standard plastic instrument case and has two PC boards, as already mentioned. The power transformer and the receiver board are mounted on the base of the case, while the pulse power board is mounted on the lid.

We will first describe the assembly of the pulse power board and show you how to get it going as a self-contained train controller. After that, we will tackle the construction of the transmitter and receiver and marry them to the pulse power board.

Fig.8 shows how the parts are mounted on the pulse power board. The 6-way connector is for the connections to the receiver board (Terminals 1-6), while the 16-way connector (actually two 8-way units) is for the rest of the connections.

Assembly of the board can start with the wire links, small diodes and the resistors. When these have been installed, you can concentrate on mounting the four output transistors, the 3-terminal regulator and their associated heatsinks.

Three heatsinks are required. Q1 and Q3 are mounted on one heatsink while Q2 and Q4 are mounted on another. We made ours from 0.8mm aluminium (equivalent to 22 gauge), although the thickness is not important.

For each two-transistor heatsink, we used a piece of aluminium 30mm wide and 55mm long, with a rightangle bend 9mm from one end, which becomes the foot. Four 3mm holes need to be drilled in each heatsink, to take the two mounting screws for the foot and the mounting screw for each transistor.

For the 3-terminal regulator heatsink, we used a piece of aluminium 20mm wide by 45mm long, with a rightangle bend 9mm from one end. Three 3mm holes need to be drilled in it, two for mounting screws and one to secure the regulator.

The three heatsinks should be secured to the PC board before the transistors and regulators are soldered into place. Note that the two transistor heatsinks must not touch each other otherwise they will short out the DC supply. Attach the regulator and the power transistors to their respective heatsinks and then you can solder their leads to the board.

Note that mica washers are not necessary for the transistors or for the regulator.

Once the transistors and regulator are in place, the rest of the components can be mounted on the PC board. We suggest that you solder in the small transistors first, then the two trimpots, the 5W wirewound resistor, the four ICs, the four rectifier diodes and the capacitors. Leave the connector strips till last, otherwise they tend to get in the way when you are soldering other components.

Note that IC1 and IC2, the two LM324 op amps, are oriented differ-

RESISTOR COLOUR CODES

Value	4-Band Code (1%)	5-Band Code (1%)
10MΩ	brown black blue brown	brown black black green brown
560kΩ	green blue yellow brown	green blue black orange brown
220kΩ	red red yellow brown	red red black orange brown
120kΩ	brown red yellow brown	brown red black orange brown
100kΩ	brown black yellow brown	brown black black orange brown
47kΩ	yellow violet orange brown	yellow violet black red brown
27kΩ	red violet orange brown	red violet black red brown
22kΩ	red red orange brown	red red black red brown
15kΩ	brown green orange brown	brown green black red brown
10kΩ	brown black orange brown	brown black black red gold
8.2kΩ	grey red red brown	grey red black brown brown
5.6kΩ	green blue red brown	green blue black brown brown
4.7kΩ	yellow violet red brown	yellow violet black brown brown
2.2kΩ	red red red brown	red red black brown brown
1kΩ	brown black red brown	brown black black brown brown
820Ω	grey red brown brown	grey red black black brown
330Ω	orange orange brown brown	orange orange black black brown
100Ω	brown black brown brown	brown black black black brown
47Ω	yellow violet black brown	yellow violet black gold brown
12Ω	brown red black brown	brown red black gold brown
2.2Ω	red red gold brown	red red black silver brown

CAPACITOR CODES

Value	IEC Code	EIA Code
0.1μF	100n	104
0.022μF	22n	223
0.015μF	15n	153
0.01μF	10n	103
0.0047μF	4n7	472
100pF	n10	101

TRIMPOT CODES

Value	EIA Code
220kΩ	224
100kΩ	104
10kΩ	103
2.2kΩ	222

PARTS LIST FOR IR MODEL TRAIN CONTROLLER

Case & hardware

1 plastic instrument case, 260 x 190 x 80
1 aluminium front panel
1 Dynamark front panel label, 250 x 75mm
1 M2165 60VA transformer
1 piece of 1.5mm gauge aluminium, 120 x 165mm
1 piece of 0.6mm gauge aluminium, 80 x 60mm
1 MU45 1mA meter
1 meter scale, 51 x 41mm
9 5mm LED bezels
1 16mm nylon bushing
1 1MΩ linear pot (VR4)
1 15mm diameter knob
1 9.5mm nylon cable clamp
1 3-way mains terminal block
1 cordgrip grommet for mains cord
1 panel mount 3AG fuse holder
1 1A 3AG fuse
2 solder lugs
2 panel mount banana sockets
1 12V buzzer
6 4BA 9mm Nylon screws plus nuts
4 6mm standoffs

Wire & cable

1 mains cord with moulded 3-pin plug
1m 5-way rainbow cable
400mm 4-way rainbow cable
400mm brown medium duty hookup wire
400mm blue medium duty hookup wire
150mm blue mains rated wire
400mm brown mains rated wire
200mm green/yellow mains (earth) wire
200mm red light duty hookup wire
200mm black light duty hookup wire
200mm green light duty hookup wire
200mm red medium duty hookup wire
200mm yellow medium duty hookup wire
200mm blue medium duty hookup wire

Miscellaneous

Tinned copper wire, solder, screws, nuts, self tapping screws, heatshrink insulating tubing, etc.

Pulse power board

1 PC board, code SC91488, 117 x 125mm
2 8-way PC board mount screw connectors
1 6-way PC board mount screw connector
2 100kΩ miniature vertical trim pots (VR1, VR2)

Semiconductors

2 LM324 quad op amps (IC1, IC2)
1 4093 quad Schmitt NAND gate (IC3)
1 4049 hex inverter buffer (IC4)
2 BD650 PNP Darlington transistors (Q1, Q2)
2 BD649 NPN Darlington transistors (Q3, Q4)
3 BC547 NPN transistors (Q5, Q6, Q8)
1 BC558 PNP transistors (Q7)
1 7812 12V 3-terminal regulator
5 1N914, 1N4148 signal diodes (D1-D5)
4 1N5404 3A diodes (D6-D9)
1 5mm bicolour LED (LED1)
1 5mm red LED (LED2)

Capacitors

2 2200μF 25VW PC electrolytic
1 47μF 16VW PC electrolytic
1 10μF 16VW PC electrolytic
1 4.7μF 16VW PC electrolytic
1 2.2μF 25VW PC electrolytic
1 2.2μF 16VW PC electrolytic
2 0.1μF MKT polyester or greencap
1 0.01μF MKT polyester or greencap

Resistors

(0.25W or 0.5W, 1%, 7mm body)

1 560kΩ	5 10kΩ
1 220kΩ	1 8.2kΩ
2 120kΩ	2 5.6kΩ
5 100kΩ	6 2.2kΩ
1 27kΩ6	1kΩ
1 22kΩ1	100Ω
2 15kΩ1	0.1Ω 5W

Transmitter board

1 plastic case, 68 x 130 x 43mm
1 PC board, code SC15204922, 88 x 57
1 front panel label, 63 x 125mm
4 black PC board mount momentary switches
4 white PC board mount momentary switches
1 grey PC board mount momentary switch
1 red PC board mount momentary switch
1 216 9V battery
1 216 9V battery clip
4 6mm standoffs
4 2mm x 20mm countersunk screws
12 2mm nuts
4 2mm washers
1 160mm-length 0.8mm tinned copper wire
1 CSB615A 615kHz Murata ceramic resonator (X1)

Semiconductors

1 MV500 Plessey remote control transmitter (IC1)
1 BC338 NPN transistor (Q1)
1 BD140 PNP transistor (Q2)
2 CQY89A, LD271 infrared LEDs (LED1, LED2)

Capacitors

1 220μF 16VW PC electrolytic
2 100pF ceramic

Resistors

(0.25W or 0.5W, 1%, 7mm body)

1 10kΩ	1 100Ω
1 1kΩ	1 2.2Ω
1 820Ω	

Infrared receiver board

1 PC board, code SC15204921, 140 x 98mm
1 CSB615A 615kHz Murata ceramic resonator
1 220kΩ miniature horizontal trimpot (VR5)
1 10kΩ miniature horizontal trimpot (VR3)
1 2.2kΩ miniature horizontal trimpot (VR6)

Semiconductors

1 SL486 Plessey infrared receiver amplifier (IC5)
1 MV601 Plessey remote control receiver (IC6)

1 4051 8-channel analog mutiplexer (IC7)
1 4066 quad analog switch (IC8)
1 LF351, TL072 dual FET input op amp (IC9)
3 4013 dual D flipflops (IC10,IC11,IC12)
2 BD681 NPN Darlington transistors (Q9, Q10)
4 BC338 NPN transistors (Q11-Q14)
1 BP104, BPW50 infrared detector diode (IRD1)
7 1N4148, 1N914 signal diodes (D10-D17)
5 1N4002 1A rectifier diodes (D18-D22)
3 12V 400mW zener diodes (ZD1-ZD3)
2 6.8V 400mW zener diodes (ZD4-ZD5)
1 7905 5V negative regulator
7 5mm red LEDs (LED3-LED9)

Capacitors

1 68µF 16VW PC electrolytic
1 22µF 16VW PC electrolytic
3 10µF 16VW PC electrolytic
1 6.8µF 16VW PC electrolytic
1 2.2µF tantalum electrolytic
6 0.1µF MKT polyester
1 .022µF MKT polyester
1 .015µF MKT polyester
1 .0047µF MKT polyester
2 100pF ceramic

Resistors

(0.25W or 0.5W, 1%, 7mm body)

2 10MΩ 5%	3 2.2kΩ
11 100kΩ	10 1kΩ
1 47kΩ	1 330Ω
4 10kΩ	1 47Ω
1 8.2kΩ	3 12Ω
1 4.7kΩ	

Parts for hand controller (for testing pulse power board)

1 plastic case, 83 x 54 x 28mm
1 10kΩ linear pot. (VR3)
1 1MΩ trimpot (VR4)
1 220kΩ trimpot (VR5)
2 SPDT toggle switches (S1,S2)
1 piece of Veroboard (50 x 20mm)
1 6-way cable (to connect to pulse power board)

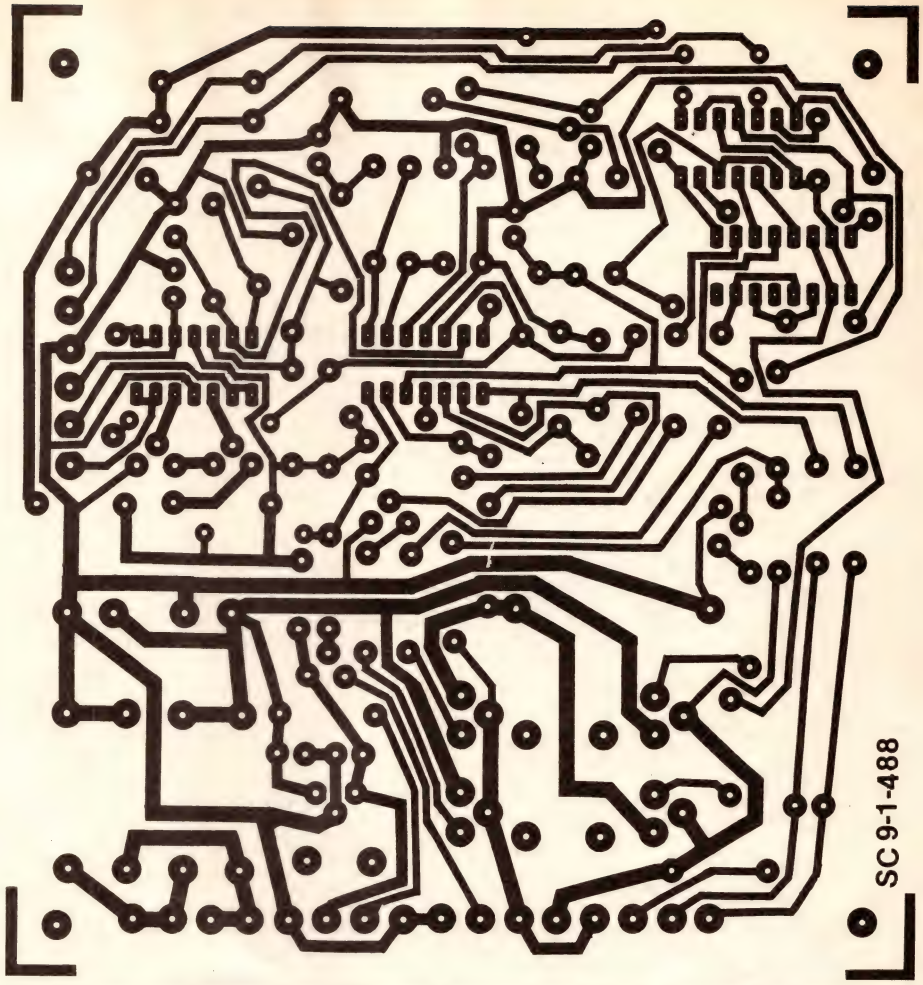


Fig.10: compare your etched PC board against this full-size artwork & correct any defects before mounting any of the parts.

ently on the board (ie, they point in different directions).

Testing

Instead of now proceeding to assemble the infrared transmitter and receiver, we suggest that the pulse power board be assembled into the case, along with the power transformer, some of the LEDs and so on. We will assume that you have purchased the full kit so there will be no need to do any metalwork, although you may have to drill holes in the plastic instrument case – see Fig.11.

In effect, you will initially be wiring up the complete project minus the receiver board. We will then show you how to wire up a simple hand control (the same as published in our April 1988 issue) so that you can put the pulse power board through its paces.

The 60VA transformer is mounted on a metal plate in the lefthand side of the case. The metal plate (we used 20-gauge aluminium sheet) is then secured to the case using four of the integral plastic pillars in the base. A 3-way insulated terminal block is required to terminate the mains wiring to the power switch and transformer. The mains Earth (green/yellow) wire is terminated to a solder lug which is attached to the transformer mounting plate.

The mains wires to the power switch and fuseholder should be fitted with heatshrink sleeving to prevent any accidental contact. When fitting the mains cord, make sure it is anchored to the rear panel of the case using a cordgrip grommet.

Mount the pulse power board on the lid of the case with four screws and nuts. We used nylon screws for this job since they are safer and the screw heads are less noticeable on the lid. Lay the lid, with the pulse power board fitted to it, to the right of the base and run the necessary wiring. The two transformer secondary wind-

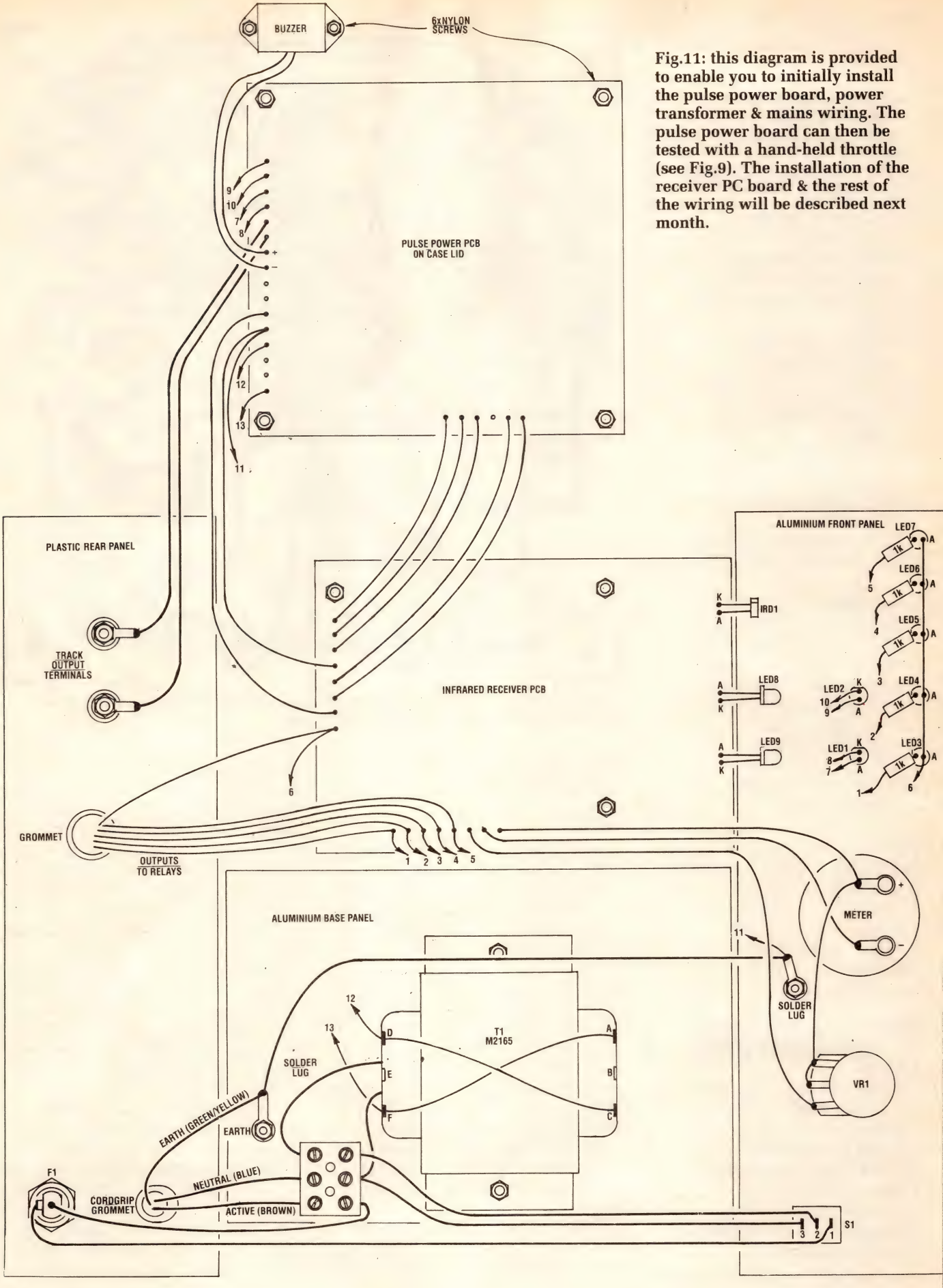
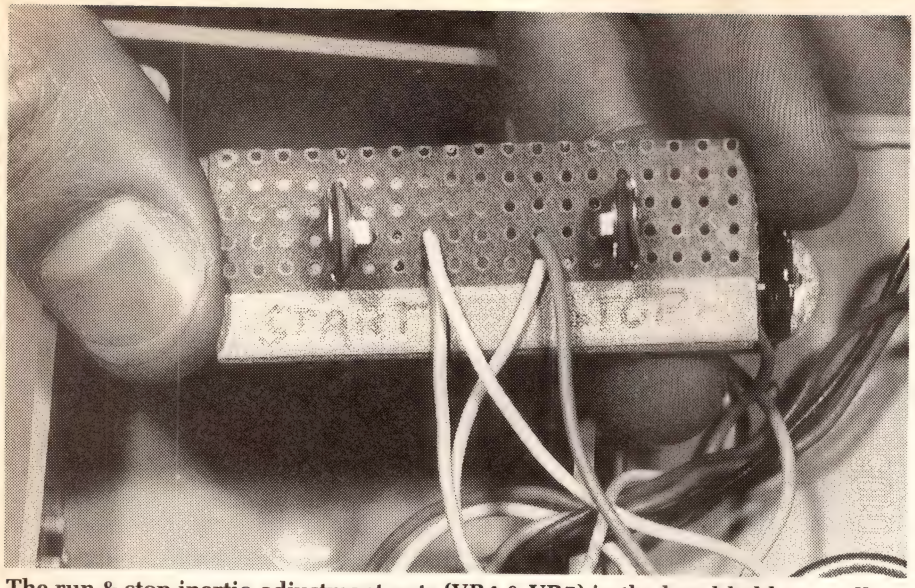


Fig.11: this diagram is provided to enable you to initially install the pulse power board, power transformer & mains wiring. The pulse power board can then be tested with a hand-held throttle (see Fig.9). The installation of the receiver PC board & the rest of the wiring will be described next month.



The run & stop inertia adjustment pots (VR4 & VR5) in the hand-held controller are mounted on a small piece of Veroboard. Note: these pots are optional for testing purposes & could be replaced by wire links.

ings are connected in parallel (0V to 0V and 12V to 12V) before being connected to the relevant points on the connector strip.

You can also wire in the overload buzzer and the output (track) leads which connect to binding post terminals on the rear panel. The LEDs can be connected directly to the connector strip at this stage, leaving the permanent wiring till later.

Handheld control

To test the pulse power board, you will need a handheld control and we have shown one wired up on Veroboard in Fig.9. It is wired up to Terminals 1-6 on the pulse power board. Switch S1 functions as a Run/Stop switch while switch S2 provides forward and reverse. VR3 becomes the main speed control, VR4 the inertia control, and VR5 the braking control. However, don't wire in the control until you have made the following voltage checks.

Powering up

Having completed the wiring, check your work carefully and then apply power. A number of voltage checks should now be made. To make these easier, orient the pulse power board in the same direction as the diagram of Fig.8 and have last month's issue open at the circuit diagram on page 70. That way, it will be easier to find your way around the board.

Switch your multimeter to the 20V DC range and check that +17V is present at the IN terminal of the 3-terminal regulator (you can pick it up at the end of the adjacent 2.2kΩ resistor) and at the emitters of Q1 and Q2. Depending on the incoming mains voltage, this measurement is likely to be anywhere between +17V and +21V, or even a little more.

TABLE 1

IC	Pins	Voltage
IC1	1, 2, 3	+1.2V
IC1	5, 6, 7	+4.8V (triangle waveform at pin 9, square wave at pin 7
IC1	8, 9, 10	Same as wiper of VR1
IC1	12, 13, 12	Same as wiper of VR2
IC2	1	+11V
IC2	2	0V
IC2	3	+0.6V
IC2	5	10.1V
IC2	6	+9.8V
IC2	7	+12V
IC2	8, 9, 10	Close to 0V
IC2	12	+1.8V
IC2	13	Same as pin 6, IC1
IC2	14	0V

Now check for +12V at the output of the 3-terminal regulator and on each of the supply pins of the ICs: pin 4 of IC1 and IC2, pin 1 of IC4, and pin 14 of IC3. Again, the actual voltage will vary between +11.4V and +12.6V, depending on the actual 7812 (or LM340T-12) used.

The voltages around IC1 and IC2, as shown in Table 1, should now be checked with the handheld throttle disconnected. These voltages are "ballpark" figures only but should be a good guide to see that things are working.

Now you can wire in the handheld control and check that the voltages at pins 3 and 4 swap from high to low or vice versa when the forward/reverse switch is operated. Check that the voltages at pins 6, 7, 9, 10, 11, 12, 14 & 15 also change state when the forward/reverse switch is operated.

Now connect your multimeter across the output terminals of the controller and wind the throttle control up to maximum. Adjust VR1 on the pulse power board so that the voltage is 12V (or whatever is the maximum recommended operating voltage for your locos). Now rotate the throttle to the minimum and adjust VR2 for an output of 1.5V (you will want to "fine tune" this minimum setting once you start operating trains).

Now note that the polarity of the output voltage changes when you operate the forward/reverse switch and that the colour of the track LED changes (from red to orange or vice versa).

Now wind the throttle to about the half-way mark and briefly short the output terminals. The overload LED should light and the buzzer should sound.

You can also listen to the operation of the controller by connecting a loudspeaker to the output terminals via a 100Ω resistor. (Don't connect it directly otherwise you'll probably blow the loudspeaker). At low throttle settings, the loudspeaker will have a thin, reedy sound. At higher settings, the sound will be louder but more mellow.

With all those checks made, you can now run trains if you like. After all, you probably want a break from soldering at this stage. Next month, we shall complete the project by presenting the assembly details of the infrared transmitter and receiver. **SC**

AMATEUR RADIO

BY GARRY CRATT, VK2YBX

Receiving weather satellite signals; Pt.2

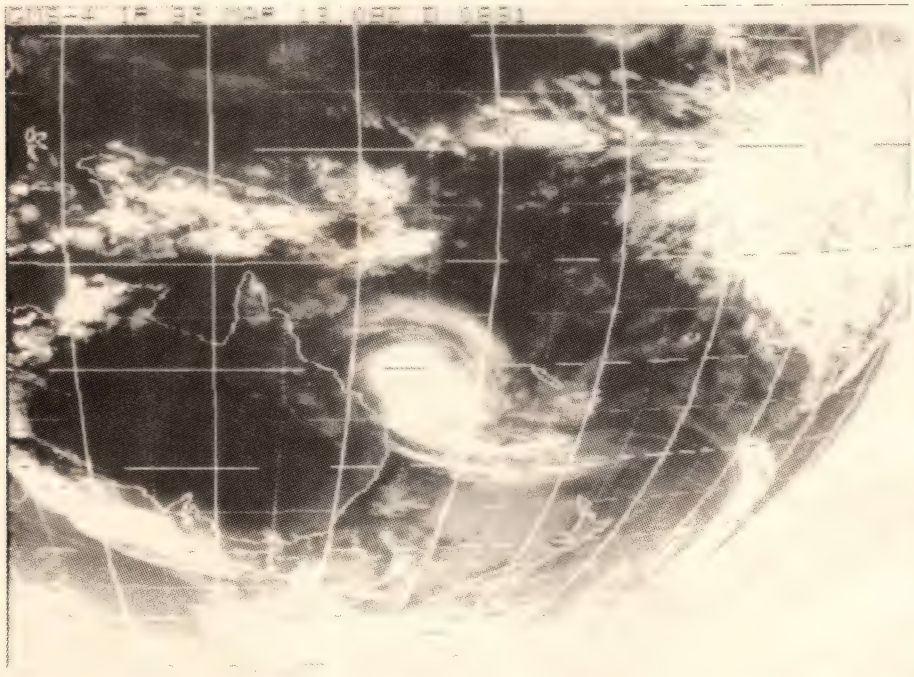
Last month, we looked at the polar orbiting weather satellites and discussed the equipment necessary to receive and decode images transmitted by them. This month, we look at the SHF transmissions which originate from the Japanese GMS-4 satellite.

The Japanese GMS-4 satellite is located in geostationary orbit at 140° east. This satellite transmits enhanced images on a frequency of 1691MHz, requiring the use of microwave techniques for good quality reception.

When one considers the minute signal levels reaching the Earth's surface (typically .05μV), it becomes apparent that considerable care must be taken to receive and display weather images from this satellite. The GMS satellite uses a deviation of ±126kHz and so the receiver must have a minimum IF bandwidth of 260kHz. This increased bandwidth means that the received noise is about 10 times larger in amplitude than from a VHF polar orbiting satellite having a deviation of ±18kHz.

In order to recover useable signals, the antenna must be capable of providing sufficient gain between the incoming signal level of -134dBm and the typical receiver sensitivity of -110dBm. This equates to a gain of 26dB, requiring a dish having a diameter of at least 1.5 metres. Such dishes are often available from satellite TV dealers, who often have damaged units of no use at 12GHz but still quite useable at the frequency of the GMS satellite. Fig.1 shows the gain that can be expected from dishes of various diameters.

The path loss between spacecraft and Earth at 1691MHz is approximately 188dB and as the output signal from the satellite is 5W (+37dBm), and the gain of the spacecraft antenna is around 17dBi, the calculated signal at the ground is -134dBm.



This image from the Japanese GMS-4 satellite clearly shows the cyclone that eventually crossed the Queensland coast during March 1992.

Receiver requirements

To obtain a good signal, the receiver should also have a noise figure of around 1.5-2dB. A popular configuration is to use a microwave mixer and local oscillator chain feeding a VHF receiver. Particular care must be taken to ensure that the local oscillator is kept as stable as possible: it will be oscillating at about 1500MHz, to produce an IF of 137MHz (for example), and any drift in the oscillator will be multiplied by 15 or so (assuming the oscillator runs a 20MHz crystal). Thus, a frequency offset of 1kHz will become a shift of 75kHz at 1500MHz.

The most important parameter of the GMS receiving system is the IF bandwidth of the receiver. Some weather satellite enthusiasts have attempted to use scanning receivers for the purpose, as they cover the SHF frequency range. However, these receivers have a wideband FM bandwidth of 150-180kHz, causing poor signal-to-noise ratio and severe limiting of greyscale resolution. A correctly

Taken from one of the NOAA polar orbiting satellites, this infrared image of the United Kingdom shows quite a lot of detail, including many small towns.

designed receiver must have an IF bandwidth of 260-280kHz.

Unfortunately, most receiver designs featured in overseas magazines are suitable only for METEORSAT or GOES satellites, which have an IF bandwidth of 40kHz. With this kind of signal improvement over GMS transmissions (+8.25dB), signals can be heard on four phased Yagi antennas. While GMS transmissions can be heard using such equipment, pictures cannot be produced, due to the reduced signal levels.

As 1691MHz is a frequency used exclusively for weather satellite transmissions, commercial feedhorns for this frequency are not readily available. Because the efficiency of the dish is related to the type of feedhorn arrangement used, the design of this component is also very important. The first step towards constructing a suitable feedhorn is to determine the focal point of the dish, so that the feedhorn can be correctly positioned. This can be calculated using the formula $F = D^2/2c$, where F is the focal point, D is the diameter and c is the depth of the dish.

Designs for "coffee can" feedhorns can be found in the *ARRL Antenna Book*, and Jessop's *VHF UHF Manual*. A table in the latter book shows both the 3dB and 10dB beamwidth required for various values of F/D. This table enables constructors to select a suitable feedhorn design, once the F/D of the dish is known, ensuring that the dish is fully illuminated and operating at peak efficiency.

As an example, a feedhorn suitable for a dish having an F/D ratio of 0.56 can be constructed using a 12cm long, 18cm wide can, containing a quarter wavelength monopole (3cm), mounted 3cm from the rear of the tube. The focal point is measured from the inside centre of the dish to the inside edge of the feedhorn.

As is the case with all microwave receiving systems, the feed must be rotated to the correct satellite polarity, corresponding to maximum signal level, and the focal point should also be fine tuned by carefully adjusting this distance for maximum signal.

Fortunately, for those without the resources or time to construct a GMS system, specially designed and prebuilt components are available. PH Communications – phone (07) 264 1575 – produces a built up GMS receiver, downconverter and dipole feed system. They also produce a suitable 1.7GHz LNA (low noise amplifier) for those who think they need it. SCISAT Products are finalising a complete GMS receiver/downconverter. QUORUM Communications (address details in last month's issue) produce a suitable downconverter, model SDC-1691B.

Fig.1: Dish Diameter vs. Gain

Diameter	Gain (dBi)
0.6	18
1.2	24
1.5	26
1.8	27.5
2.0	29
2.4	30
3.0	32

Polar orbiters

There is yet another mode of transmission used by the polar orbiting weather satellites described in our first article. These polar orbiters produce extremely high resolution pictures and the data is transmitted on frequencies similar to GMS.

In the case of NOAA 9 & 11, this frequency is 1707MHz. For NOAA 10 it is 1698MHz. Data is collected from spacecraft instruments such as the Advanced Very High Resolution Radiometer (AVHRR), the Operation Vertical Sounder (TVOS), the Space Environment Monitor (SEM), the Data Collection System (DCS) and the spacecraft telemetry system.

The subject of HRPT signal reception is quite complex and extremely interesting. Dedicated newsletters for enthusiasts are available, such as the *Journal of the Environmental Satellite Amateur Users Group*. This is published by the Dallas Remote Imaging Group, 4209 Meadowdale Drive, Carrollton, TX 75010 USA. Several copies perused in our office indicate that this newsletter contains a high level of quality information.

Further reading

(1) "High Resolution Weather Satellite Pictures," M. L. Christieson, Wireless World December 1981 and January 1982.
(2) "Tracking Low Earth Orbit Satellites At L/S Band", "Break In" NZART publication, March 1989.

Acknowledgment

I would like to thank Mr Brian Buckingham and Mr Fred Lehner for their time and assistance in supplying background information. **SC**

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November 1988: 120W PA Amplifier Module (Uses Mosfets); Poor Man's Plasma Display; Automotive Night Safety Light; Adding A Headset To The Speakerphone; How To Quieten The Fan In Your Computer; Screws & Screwdrivers, What You Need To Know; Diesel Electric Locomotives.

December 1988: 120W PA Amplifier (With Balanced Inputs), Pt.1; Diesel Sound Generator; Car Antenna/Demister Adaptor; SSB Adaptor For Shortwave Receivers; Why Diesel Electrics Killed Off Steam; Index to Volume 1.

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June 1989: Touch-Lamp Dimmer (uses Siemens SLB0586); Passive Loop Antenna For AM Radios; Universal Temperature Controller; Understanding CRO Probes; LED Message Board, Pt.3.

July 1989: Exhaust Gas Monitor (Uses TGS812 Gas Sensor); Extension For The Touch-Lamp Dimmer; Experimental Mains Hum Sniffers; Compact Ultrasonic Car Alarm; NSW 86 Class Electric Locomotives.

August 1989: Build A Baby Tower AT Computer; Studio Series 20-Band Stereo Equaliser, Pt.1; Garbage Reminder – A 7-Day Programmable Timer; Introduction To Stepper Motors; GaAsFet Preamplifier For The 2-Metre Band; Modern 3-Phase Electric Locomotives.

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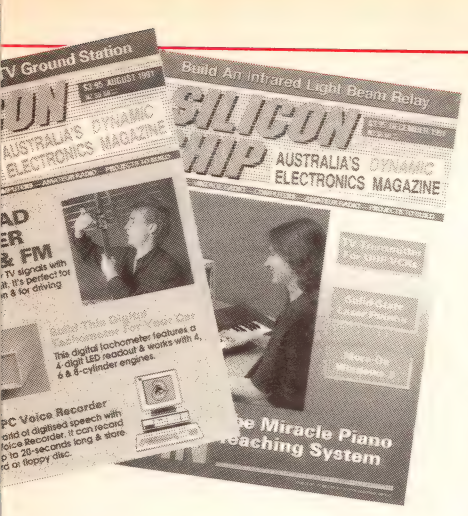
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Transistor replacements

On the Brake Light Flasher Circuit (described in the April 1989 issue of SILICON CHIP), is there another transistor I can use instead of the BD645? I have catalogs from Altronics, Rod Irving, Dick Smith Electronics and Jaycar, and none of them list BD645.

And in Fig.2 of the article on the Car Antenna Adaptor (SILICON CHIP, December 1988), the photo shows two wires that come from the power to the circuit board, with (+) going to L2 and (-) is going to L1, but on the other side of the toroid it shows L1 going to (+), and L2 going to (-). Does it make any difference which wires go to the demister?

Also in the text it specifies that the 75-ohm cable should have a 1.25mm central core. Most of my catalogs don't list the sizes of the central core of their 75-ohm cable and the largest size that is stated is 0.95mm from DSE. Where can I get 75-ohm cable with a 1.25mm central core?

Finally, the toroid core is specified as Neosid 28-042-31 F14 ferrite but I can't find that part in any of the catalogs I have. The closest I can find is a toroid core, size OD 44 x ID 24 x H 16.5mm, which is the type I bought. (O. M., Liverpool, NSW.)

• In the Brake Light Flasher project you can replace the BD645 transistor with a BD649, which is available from Altronics in Perth for $2.65. This transistor is virtually identical to the BD645 except that it has a higher voltage rating.

For the Car Antenna Adaptor project, we haven't tried the toroidal core you mentioned in your letter, however as the application is not all that critical, we cannot see why it wouldn't work.

You can substitute 50-ohm coaxial cable for the 75-ohm type. A suitable type would be Dick Smith Cat. W-2099. It does not make any difference which wires go to the demister.

Current rating for solar battery charger

I am after some more information concerning the "Battery Charger for Solar Panels" that appeared in the November 1991 edition.

I am considering using the charger with an SLA battery but one that requires a float voltage of between 13.6V and 13.8V for standby use. It is intended to connect the charger's input to an automotive electrical system.

The SLA battery I have draws a peak current of around 2A, which quickly dies away to a fraction of this as the battery charges. I wish to know the maximum continuous and maximum peak current the charger can supply, as this information does not appear anywhere in the article. I would also like to see a graph of load voltage against load current.

Apart from this omission, the circuit would seem to be ideal for the intended application and, with the addition of a constant current sink, could be used to charge nicads while in a mobile environment (eg, battery packs for hand held radios).

Your thoughts and ideas on this application for the charger would be greatly appreciated. (W. S., Endeavour Hills, Vic).

• The capacity of the circuit is about 2A, although this will depend more on the solar panel than the circuit components. It should be suitable for your SLA battery. It could also be

Remote control extender

I have constructed the remote control extender published in the September 1990 issue of SILICON CHIP but I have been unsuccessful in getting it to operate. The indicating LED does light up when the remote controller of the VCR is operated, however the signal is not being received at the VCR end.

Can you please help me with the following questions:

(1) What should the output voltage at pin 9 of the SL486 be when high? Using a multimeter, the voltage is 200mV when low and varies little when high. From data sheets, this voltage should be Vcc (the supply voltage). I replaced this chip and the same results occurred.

(2) What should the voltage be at the receiving end; ie, at the infrared LED?

(3) The BPW50 chip has been replaced by a BP104. Is this OK?

Your help would be appreciated. (B. M, Rockhampton, Qld).

• The BPW50 can be replaced by a BP104 but you have replaced the SL486 unnecessarily as it was probably behaving normally. Some constructors are having low sensitivity problems with this unit. When re-transmitting an infrared remote control signal, the red acknowledge LED flashes to indicate reception of this signal, as you have found. However, the infrared LED (IRLED1) may not provide a satisfactory output for some or all of the remote control functions.

This problem is caused by IC1's AGC attack time being too short when used with some infrared remote controls. To solve this problem, the 0.15µF capacitor at pin 8 of IC1 should be changed to a larger value. Some experimentation may be required to find the best value, which should be in the range from 6.8µF to 22µF (use an electrolytic). The positive terminal of the capacitor connects to pin 8 of IC1 and the capacitor should be rated at 16VW or higher.

used for nickel cadmium batteries provided you included a timer or some other means to avoid overcharging.

Exhaust gas analyser would be a good project

I am writing to enquire whether or not you may have considered publishing an exhaust gas analyser in your magazine. As a motoring enthusiast who likes to work on my own car, I often have wished for an exhaust gas analyser to set the mixture on the carburettor but sadly, commercial units cost many hundreds of dollars.

These electronic units use infrared pickup devices, calibrated accordingly, or "hot wire" resistance devices. Perhaps even the sensing device in the exhaust gas detector project published in the July 1989 issue could be used? I'm sure this project would be very popular, as digital tacho/dwell projects for cars have been very popular too. (S. L., North Balwyn, Vic).

• It would be relatively easy to develop a suitable circuit and, as you suggest, it could be based on a semiconductor gas sensor similar to that used in the exhaust gas detector featured in the July 1989 issue of SILICON CHIP.

The big problem is how to calibrate the circuit. It must either be calibrated in a standard gas mixture or against a standard gas analyser. We don't have the solution to this problem, otherwise we would have published the circuit already.

Improvements to the SLA battery charger

I'd like to make a suggestion concerning Darren Yates' Sealed Lead Acid Battery Charger in the March 1990 issue. This turned out to be a terrific charger after ironing out some bugs: (1) figuring out the way voltage select switch S3 is hooked up; and (2) figuring out why the charge state LEDs would not behave.

The person I assembled this charger for raised the possibility of damage to the charger through leakage from the battery when the unit was switched off with the battery still connected. I had a 24V relay lying around, so I connected the coil to the 24V DC that enters the board and the 'normally open' contacts to the positive lead running to the battery being charged. Thus, when the unit is off, the battery is isolated.

This proved to be most effective and I intend to use it on all applicable projects in the future, as an additional safety feature to augment any diodes used for this purpose.

The last point I'd like to make about this project is the mains switch only switching the Active line. Since the switches supplied with most kits are DPDTs, why not switch both Active and Neutral for safety? (P. B., Epping, NSW).

• In view of some recent feedback on this project, we are looking to revise the circuit and present it again some time later this year. The main problem seems to be associated with the wiring of the switches and the use of LF347s as comparators but otherwise the original circuit was quite practical.

There is no need to provide relay isolation, as the existing diodes in the circuit provide this feature.

As far as the mains switching is concerned, there are no real advantages in switching both Active and Neutral, although we have on occasion used DPDT mains switches. On the one hand you can say that if Active and Neutral switching is included, the appliance will definitely be off when switched off.

However, we still regard the only safe mains appliance to work on as one with the mains plug pulled out of the wall socket. On the other hand, if only the Active is switched, the mains wiring is simpler and there are less chances of mistakes.

Questions on amplifier design

My questions concern the articles published in February and April 1991, "A Practical Approach to Amplifier Output Stage Design".

With regards to the output stages, can more transistors (for each part of the amplifier) be connected in parallel to help provide more collector current? From what I can gather, this is used extensively in car amplifier design and surely beats having to use TO-3 transistors (although they may handle a lot of power, they take up a lot of space, and their construction makes it harder to use fan cooling).

A large number of car amplifiers use up to 14 transistors in each channel, and maintain a relatively small case. The author, David Eather, talks about transistors in common collector mode, and using emitter resistors for equal current sharing. Is the above essentially what he means?

David Eather also discusses the use

Sports coil does not give better spark

I have built the High Energy Ignition System described in the April 1988 issue of SILICON CHIP. On two occasions now it has failed. On the first occasion it blew the Darlington transistor, the IC and one of the polyester capacitors. On the second occasion, all the zener diodes had gone short circuit.

Is there anything wrong with the design? My friend seems to think that it is because I am using a sports coil rather than the original coil fitted to the car. (A. K., Haberfield, NSW).

• Your friend is dead right. If you use a sports coil with this circuit, you are bound to blow it up sooner or later. Because of the inbuilt dwell extension, the High Energy Ignition circuit causes considerably more current to flow through a standard ignition coil, thereby increasing available spark energy.

A sports coil also draws considerably more current when fitted to a standard Kettering ignition system. Fitting a sports coil to an electronic ignition system with dwell extension is just asking for trouble as the current will be increased even further. No wonder you blew the Darlington transistor.

The High Energy Ignition circuit gives more than enough spark energy with a standard coil. The only possible result of fitting a sports coil to it, apart from eventually blowing the system up, is that the spark plugs would be more quickly eroded and ultimately, would have to be replaced more often.

Need we say more? Don't use a sports coil!

Pulse current in IR LEDs

With the infrared lightbeam relay published in the December 1991 issue, how was the value of the 15Ω resistor in series with the LEDs calculated; ie, what were the values of forward voltage across the LEDs and what value of current was used?

Also, can the infrared emissions be focussed with lenses and would the point of focus be much different to that of red light? In the same issue of SILICON CHIP there was a TV transmitter for VCRs. The output impedance of the transmitter was quoted as 75 ohms. Is this determined by L2 and the 220pF capacitor or is this a characteristic of the OM350? (D. A., Findon, SA).

• The 15Ω resistor in the light beam relay circuit was selected to give a peak current through the LEDs of between 300 and 400mA. This gives a forward voltage across each LED of about 1.8V. The LEDs are able to pass a maximum repetitive peak current of 1A but only at very short duty cycles. Our circuit meets those requirements.

You could focus the infrared light with lenses and thereby improve range and sensitivity. The point of focus would be little different to that for red light.

As far as the TV transmitter is concerned, the output stage of the OM350 is designed to drive 75-ohm loads. Its actual output impedance is, of course, much lower.

of Mosfets in the output stage. Are these similar to using bipolar transistors? We covered Mosfets in electronics as a "basic idea" course and from what I can see, they are a totally different "can of worms".

Any information on how these transistors are used in amplifier circuits would be greatly appreciated. Will the driver transistors be affected by the extra transistors used to handle increased collector current and if so, how can this be remedied? Can the DC-DC circuitry use this same technique, so that it can handle increased current, in both the oscillator transistors (the final stage) and the DC regulator?

Do transistor SOAR curves follow a hyperbolic function, with the limits being their maximum V_{ce} and I_c?

When I was poking around in my mother's car one day, I noticed that the back shelf had provision for three 6 x 9-inch speakers and not long after, I thought of designing a circuit which would split a stereo signal into three channels: left only, that which is common to both channels and a right only channel.

There was a stereo enhancer project (ETI-1405) which worked in a similar manner. Instead of subtracting the centre, L and R are isolated and added back later on.

Any help with the questions I have presented here will be greatly appreciated. (B. M., Giralang, ACT.)

• It is common practice to parallel output transistors to obtain greater current capability in the output stages of amplifiers. We have done this several times with amplifiers published in SILICON CHIP, the most recent example being the 50 watt per channel stereo module featured in the February and March 1992 issues.

The limit on how many output transistors can be connected in parallel is set by the current capability of the preceding driver transistors but some big commercial amplifiers we have seen have had as many as six output transistors in parallel, making a total of 12 output transistors. Emitter resistors are used to improve current sharing but the transistors need to be reasonably well matched even so.

Mosfets are a different ballgame since they are transconductance devices (ie, amps controlled by volts). We featured an amplifier with Mosfets in the output stages in our November and December 1988 issues.

The SOAR (safe operating area) curve of a power transistor represents a power derating at higher voltages and as you have correctly surmised, the curve is a hyperbola but with a steeper slope than the hyperbola drawn from the transistor's nominal power rating.

We note your comments about car amplifiers using large numbers of transistors. However, car amplifiers do not just parallel a lot of output transistors to get sufficient power as this approach would still not give adequate power into loudspeakers with a nominal impedance of four ohms, or even two ohms. Commonly, car amplifiers use two amplifier stages in each channel and these drive the speakers in bridge mode. This means the maximum voltage to the speaker is doubled and hence the power is quadrupled (in theory).

The bigger car amplifiers also incorporate a DC-DC inverter to boost the supply up and thus enable much more power to be developed.

We are not keen about your 3-channel circuit concept. It really is not necessary. All stereo recordings have a substantial amount of signal common to both channels and since this is reproduced by both speakers, it avoids any "hole in the middle effect".

How to magnetically shield loudspeakers

How do you magnetically shield a loudspeaker case to stop it affecting the television nearby. (I hope to sit the TV on a homemade subwoofer enclosure). Keep up the great magazine! (H. P., San Remo, Vic).

• As far as magnetically shielded loudspeakers are concerned, it is not the case or the chassis which needs shielding but the ferrite magnet. This is shielded, during manufacture, by a steel cup which is fitted over the magnet. In the case of the more sensitive speakers with a bigger magnet structure, an additional magnet is interposed between the steel cup and the main magnet, to help cancel out any leakage field.

We think that it would be difficult to satisfactorily shield an existing speaker unless you had the correctly designed hardware.

Notes & Errata

TV Transmitter for UHF VCRs, March 1992: the 12V supply connections shown on the overlay diagram of page 18 are reversed. Also the photo of the underside of the transmitter board is for the version described in December 1991. The components on the copper side of the board are not used in the UHF version. SC

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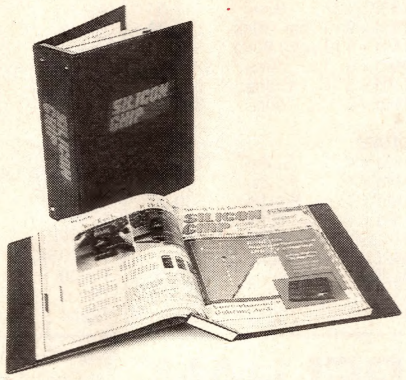

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